CERVICAL CONIZATION TECHNIQUE

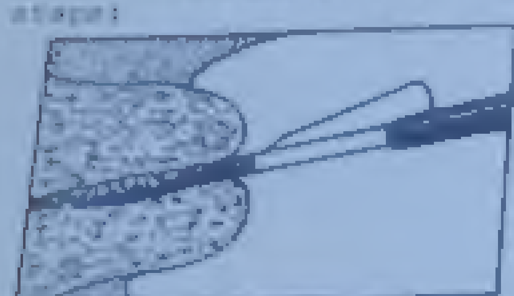
With the vaginal speculum inserted to expose the cervix, the vagina and cervix are freed of all discharge by swabbing. It is important that the cervix be perfectly dry.

The indifferent electrode is placed under the patient's buttocks or over the abdomen(held in place by sandbag or pressure of patient's hands) and connected to the Bovie Unit.

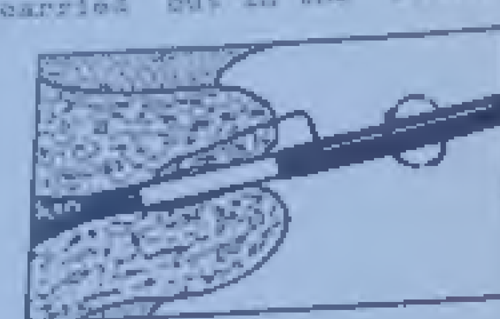
The cervical canal is measured and the depth necessary to insert the instrument is noted. The tip of the instrument should reach the internal os to assure excision of ALL the cervical mucosa.

The proper coning electrode is inserted in handle, which is connected to the active terminal of the Bovie Unit. The cutting current is set to deliver the proper amount of power.

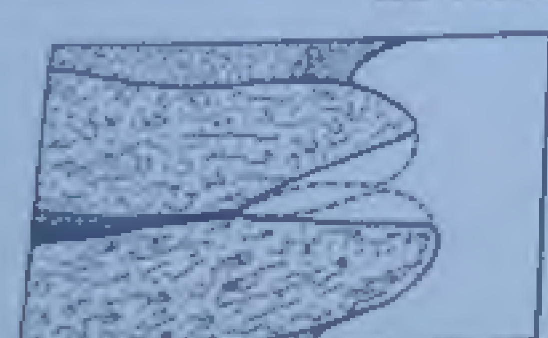
Actual conization is then carried out in the following steps:



1 - Tip of instrument is placed into the external os with loop just contacting the tissue. Cutting current is turned on with the foot switch and instrument advanced into the canal to the required depth, the loop cutting its way in. The insulated tip guards against cutting the internal os.



2 - With the current on, the instrument is rotated through one full turn (not necessarily in a single motion) which results in the excision of a cone shaped segment of cervical tissue. The extended insulated tip serves as a fulcrum for the even turning of the electrode.



3 - Foot switch is released and the instrument withdrawn, bringing with it the excised piece of tissue.

(See Reverse Side)

SURGERY OF RECTAL DISEASES BY ELECTROTHERMIC

DESTRUCTION OF LESIONS WITH

ELECTROSURGICAL EXCISIONAL BIOPSY*

E. N. KIME, M.D.

Early recognition, accurate histologic diagnosis and prompt eradication are cardinal principles in the control of cancer. The general public has become "cancer conscious." The general physician is often consulted for advice as to the correct management of the "chronic ulcer, the scaly bleeding wart, the irritated blue black mole and the lump which has changed in size and shape."

The prophylactic removal of "precancerous" lesions has been well established. Routine biopsy upon such neoplasms often shows that they have already undergone malignant change. The pro-

Do not remove from surgery.

CAUTION

L-F Bovie Electrosurgical Units are sold only for use by qualified physicians and surgeons. The observance of safe and established medical practices is essential to their proper use, otherwise there are possibilities of injury to patients or operators.

PREVENTION OF HIGH FREQUENCY SKIN BURNS

Burns are possible either from the indifferent electrode (if improperly prepared and applied) or from the active electrode if it is carelessly handled or laid on the patient when not in use.

Edges of the indifferent plate should be turned back on themselves and applied away from the patient's skin. The plate should be rolled flat each time before using (wrinkles, irregularities or sharp points will cause concentration of current and probable burns). To insure good contact, the plate and patient's skin should have a generous application of heavy soap lather or K-Y Jelly and, under no circumstances, should the plate be applied over hair or hard scar tissues. Hair and scar tissue are non-conducting and may cause concentration of current at other points under the electrode.

When not in use, the chuck handle and active electrode should be placed on the sterilizable instrument rack attached to the machine because, if laid on top of patient, a burn may result if footswitch is depressed.

PREVENTION OF BURNS RESULTING FROM ACCIDENTAL IGNITION OF INFLAMMABLE FLUIDS

When an inflammable fluid (such as alcohol) is used to cleanse the field preparatory to surgery, it is well to remember that there is possibility of igniting any residual liquid by a spark from the electrode. When inflammable fluids or solvents are used, allow sufficient time for complete evaporation and be sure that dressings, coverings, clothing, etc., surrounding the field are not saturated with the liquid.

PREVENTION OF EXPLOSION FROM IGNITION OF INFLAMMABLE INHALANT ANAESTHETICS

The use of an electrosurgical machine imposes some limitations on the type of anaesthetics which can be safely used. Choice of anaesthesia should be made with full consideration of the danger of using electrical sparks in the presence of explosive gasses.

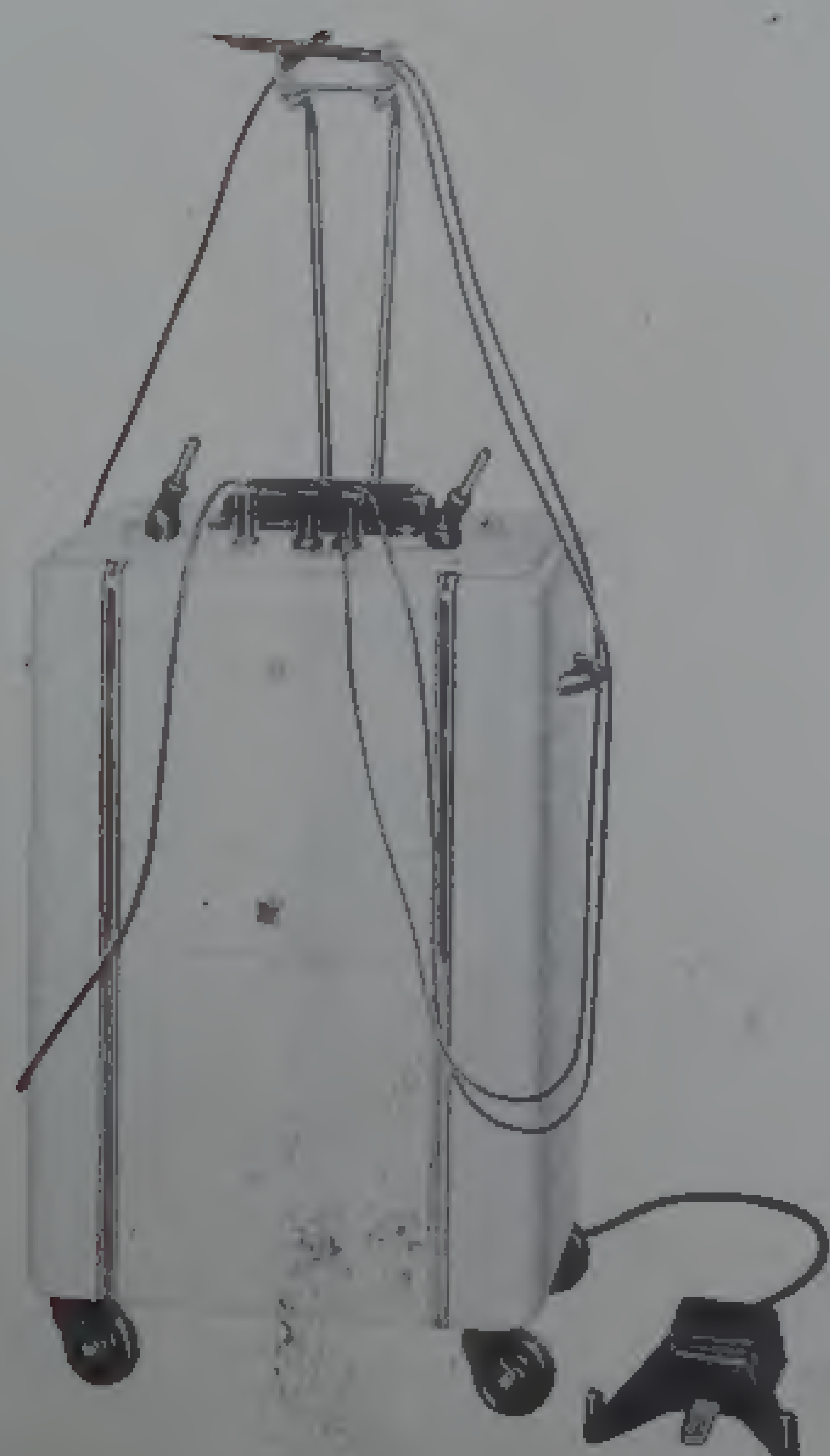
Some gasses, such as ethylene, cyclopropane and vinyl ether, are so explosive in small concentrations that they should never be used with electro-surgery. Ether, while dangerous in the absence of proper precautions, can be used with reasonable safety by the "closed method" if the patient's head and the anaesthetist are separated from the operating field by moist drapes, if the operating room is continuously ventilated, and care is taken to prevent spillage and to immediately remove empty ether cans.

It should be recognized, of course, that all commonly used inhalant anaesthetics are inflammable and especially so when used with oxygen. Therefore, caution is advised even when such "comparatively safe" gasses as nitrous oxide and chloroform are used.

No inhalant of even the slightest degree of inflammability should be used when there is any communication between the operating field and the respiratory passages.

With present day techniques for administering spinal, intra-muscular, oral and rectal anaesthetics, together with the safer gasses, the surgeon has a wide choice from which to select an appropriate anaesthesia for any electrosurgical procedure.

Connecting and Operating
INSTRUCTIONS
FOR
MODEL "O-3" *Bovie*
ELECTROSURGICAL UNIT
[THE OFFICE BOVIE]



INDEX

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO SET UP OR USE THE MACHINE. OBSERVE ALL GENERAL PRECAUTIONS SET FORTH IN SECTION V.

The LIEBEL FLARSHEIM Co.

CINCINNATI 2, OHIO

F-530-5-50

Instructions for Connecting and Operating the Model "O-3" Bovie

(I)

SETTING UP THE APPARATUS

This apparatus, carefully packed and crated for shipment, will arrive in perfect condition unless grossly mishandled in shipment. If there is evidence of damage, a claim should be filed immediately with the transportation company.

The Bovie is packed in one specially constructed carton. The accessories will be found in the drawer of the unit. The Instrument Rack is packed in one corner of the carton.

All items should be carefully checked against the packing list which will be found in the drawer.

CONNECTION TO POWER SUPPLY

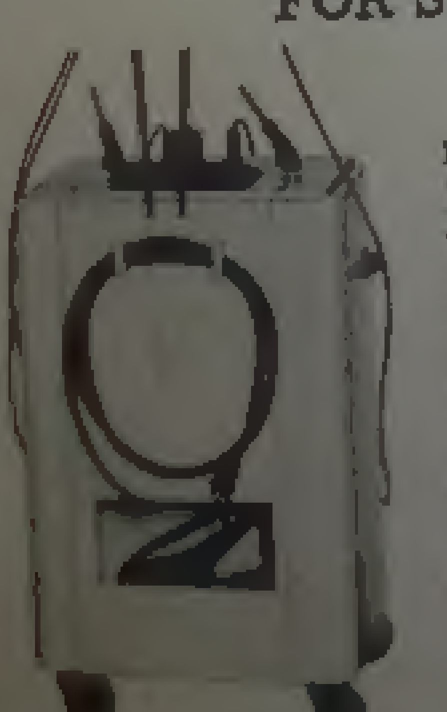
The Supply Cable is fitted with a male plug at one end (for connection to the supply receptacle) and a twist lock female plug for connection to the male receptacle located in the back of the footswitch bin (see picture at bottom of page).

Unless otherwise specified on the nameplate, this Bovie is constructed for use on 50 - 60 cycle alternating current with voltage range from 105 to 125 volts. Be sure current supply matches rating of machine shown on nameplate. If in doubt, call an electrician to test the line for correct voltage and sufficient amperage. The line should be safe for at least 15 amperes, and the voltage should be tested with the machine on load (operating with foot-switch depressed, selector switch on "cutting", and power control at 100).

FOOTSWITCH CONNECTION

The footswitch receptacle is located alongside the supply cable receptacle in the back of the footswitch bin (see picture below). The connecting plug of the footswitch cord is male so that there is no possibility of confusing supply cable and footswitch connections.

BIN FOR FOOTSWITCH AND HOOKS FOR SUPPLY CABLE



When it is necessary to move the Bovie from place to place, it is not necessary to disconnect the footswitch and supply cable from the machine. Simply slip the footswitch and cord into the bin in the back of the cabinet; disconnect the supply cable from the wall plug and coil it over the hooks which are provided on the back panel of the unit. (See illustration at left.)

INSTALLING INSTRUMENT RACK

The two screws (with black washers) in the center line of the cabinet back are for the purpose of attaching the Instrument Rack. Remove these two screws.

Unwrap the instrument rack, removing the tape which holds the bracket in place in its proper relationship to the support rods. With rack in place, attach the bracket to the back of the cabinet with the two screws (and washers) previously removed.

INSTRUCTIONS FOR GROUNDING CABINET

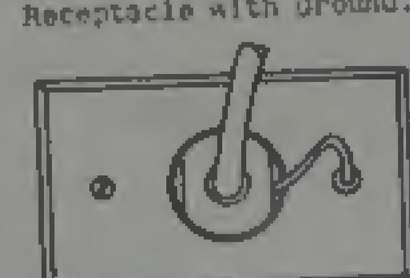
It is an accepted practice to ground all electrical apparatus housed in metal cabinets. Accordingly, the necessary wires and screws to ground the apparatus are included with the Bovie. These will be found in an envelope in the drawer.

Because most modern wall-box receptacles are grounded, a good ground can usually be had by connecting the green lead on the male end of the supply cable directly to the receptacle box cover (see example [1] and [2] below). However if there is any doubt about whether the wall-box receptacle offers an adequate ground, the ground connection should be made to a radiator steam line or a cold water pipe (see example [3] below).

To be sure about which method of grounding to use, determine first whether or not your wall-box receptacle is grounded. Remove the cover and see if a metal pipe or "BX" flexible cable is connected to the outlet box. If so, you may make your ground connection to the box as in examples [1] or [2]. If not, or if you are unable to determine whether the wall box is grounded, use method under example [3] -- or consult building superintendent, architect, or electrician.

EXAMPLE 1. - SINGLE RECEPTACLE WITH GROUND

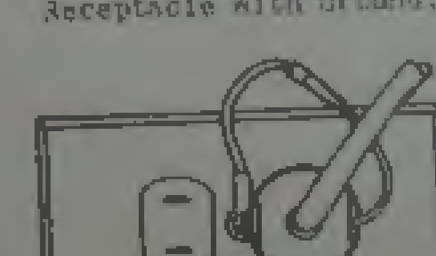
No. 1 - Single Outlet Receptacle with Ground.



Remove one of the screws from the outlet plate. Replace this screw with the threaded end-piece from the green grounding lead. This end-piece can be pulled off the green lead for the purpose of screwing it into the wall plate. Then push the sleeve back over the end piece and the cable is grounded.

EXAMPLE 2. - DOUBLE RECEPTACLE WITH GROUND

No. 2 - Double Outlet Receptacle with Ground.

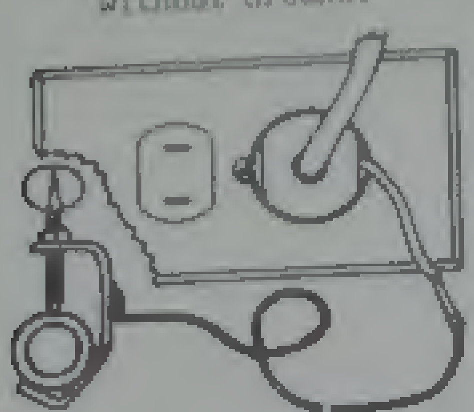


On this type of receptacle, it will be necessary to use the short-ground wire included with grounding accessories, because the screw only (as used with single outlet) would be in the way of plugging in the supply plug. Remove the screw from the plate and slip it through the ring

end of the ground wire -- then replace it and screw it tightly to the wall plate, being sure that you get a good metal-to-metal contact. Then connect the other end of the short-wire to the green lead, as illustrated.

EXAMPLE 3. - OUTLET RECEPTACLE WITHOUT GROUND

No. 3 - Outlet Receptacle Without Ground.



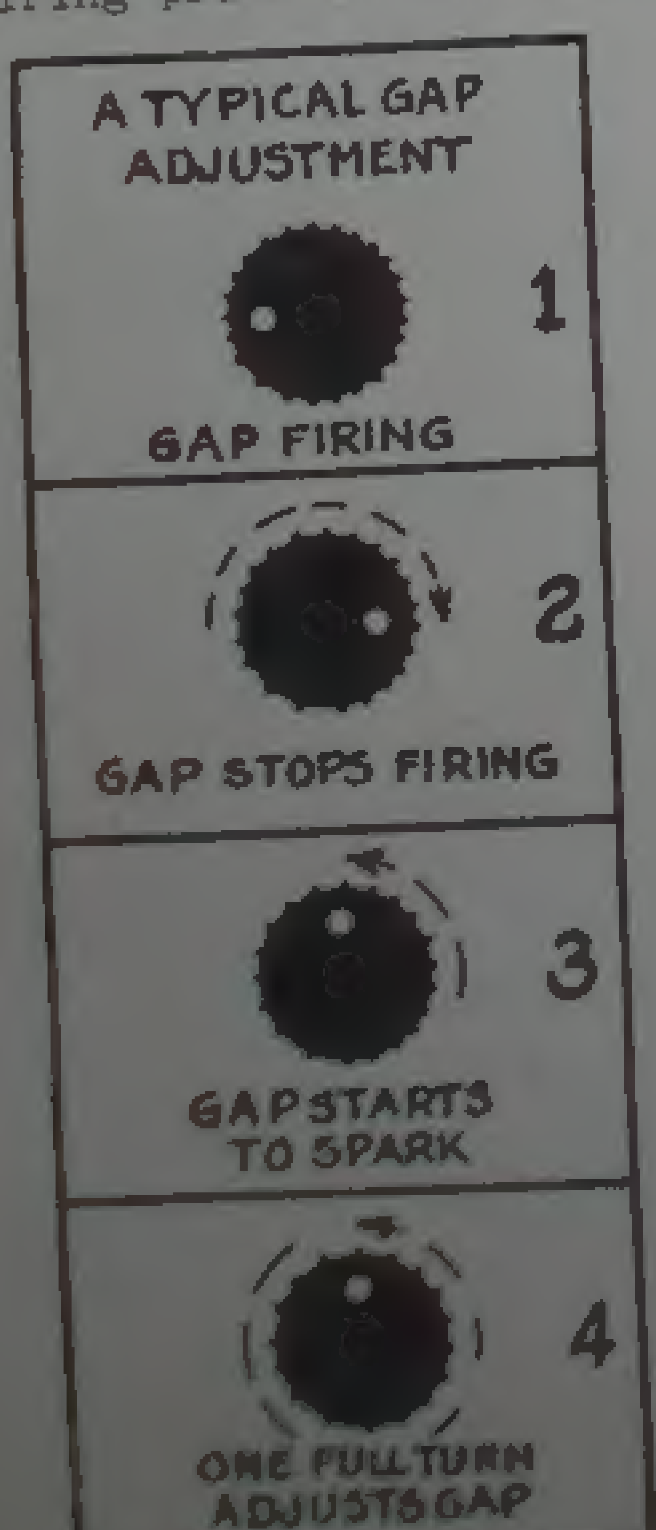
If it is necessary to ground to a water pipe, use the long grounding lead with pipe clamp furnished with grounding accessories. Be sure that the grounding clamp makes good metallic contact. Fasten the clamp securely to cold water pipe if possible -- making sure that point of clamp pierces through any paint and into metal. Then connect the other end of the long wire to the green lead, as illustrated.

ADJUSTING SPARK GAPS

Firing of the gaps may be observed through the glass window. Immediately above each gap is its adjustment knob. Turning the knob clockwise closes the gap; counter-clockwise opens the gap.

As the quality of the current is dependent on spark-gap adjustment, it is essential that this operation be accurately and properly performed. There is nothing difficult about the gap adjustment -- on the contrary, it is a rather simple procedure -- but it must be done just right to insure satisfactory performance.

TO ADJUST GAPS, first move Selector Switch to either the "Cut" or "Coagulate" position. Step on foot switch to start current flow through gaps. Then look at the gaps through observation window. If any of the gaps are not firing, turn the proper adjusting knob (or knobs) counter-clockwise to open the gaps slightly until all start to fire. It is essential that all gaps be firing prior to adjustment.



1 - After all gaps are firing, close each gap by turning the knob clockwise until gap stops firing and no spark is seen when looking through the window, (being sure your eye is carefully aligned with the gap). Close all gaps in this manner.

2 - Starting with the left knob, slowly turn it counter-clockwise until you see the gap start to spark, THEN STOP! ---- and note position of small white dot on knob.

3. TURN KNOB COUNTER-CLOCKWISE ONE FULL TURN, (as determined by position of dot) which will put that particular gap in proper adjustment. ADJUST ALL GAPS IN THIS MANNER.

It is important that the observer's eye be lined up directly in front of the sparking surface of gap being adjusted. The best way is to close one eye, and moving the head laterally in front of the gap, stop at the point where firing seems most intense. The arc that takes place is quite small and, if viewed from even a moderate angle, you may not see the first sparking in the gap from which point the subsequent one turn counter-clockwise adjustment must be made.

For best performance the gap adjustment should be made each day before operations are started. While the gaps will, under ordinary conditions, retain their adjustment over quite a period of time, they get slightly out of adjustment if the machine is moved around or jolted, and for assurance of satisfactory performance we recommend a complete gap adjustment each day before starting to work.

When correctly adjusted, intensity of the arc in each gap should appear about the same to the eye. If a particular gap appears to fire with less intensity than the others, it probably means that it has not been opened enough and should be completely readjusted in accordance with the above instructions.

If any one gap fires irregularly or sputters, it very likely means that the gap needs readjustment because it has been opened too wide.

With the gaps properly adjusted you will hardly hear the arc that takes place when current is on. (Don't confuse the 60 cycle transformer hum with the high pitched hissing note of the arc.) If one or more of the gaps are opened too wide, or if they are adjusted improperly so that one takes most of the load, there will be a decided sputtering in that one gap (or all gaps if all are open too much). The sputter can b seen and its crackling sound is distinctly heard A single sputter at rare intervals is of no con sequence, but if heard often or continuously all gaps should be correctly adjusted.

We have elaborated on this spark-gap adjus ment, not because it is difficult or complicate but rather on account of its relative importanc Correct gap adjustment is essential to sati factory operation, particularly of the cutti current. If the machine seems to lack cutti power -- if it cuts slowly -- or if there is cessive amount of dehydrated tissue on edges the wound -- these are sure signs that the are not in adjustment and they should be prope set before further use.

Remember these simple instructions:

HAVE ALL GAPS FIRING BEFORE TH ADJUSTMENT IS STARTED

HAVE THE EYE LINED UP DIRECTLY WITH SPA SURFACE and catch the point where firing begins. This is a critical factor in the ad ment. You must see the very first twinkl then open the gap one full counter-clo turn from the point where firing was fir served.

ADJUST ALL GAPS EACH DAY BEF WORK IS STARTED

These Bovie gaps incorporate a patented, self-compensating feature which their continuous, satisfactory operati consistent performance. When properly ad

the machine is brought to a condition of stability and, under equivalent conditions, results can always be duplicated -- you know in advance the results to be expected from a given power setting.

IF UNABLE TO MAKE GAPS FIRE

1. Make sure that machine is connected to correct current supply.
2. Make sure that the supply line is not "dead" because of burned out fuses or other reasons. Pilot light will glow when machine is connected to proper current supply and Selector Switch is on "Cutting" or "Coagulating". If pilot light does not glow, look for trouble in your supply line.
3. See that the footswitch is connected.
4. See that current selector is on "Cut" or "Coagulate".
5. Occasionally some uninformed persons may start to "play" with the machine and close one or more gaps several turns or open them up a number of turns. If this occurs it may appear impossible to get the gaps to fire.

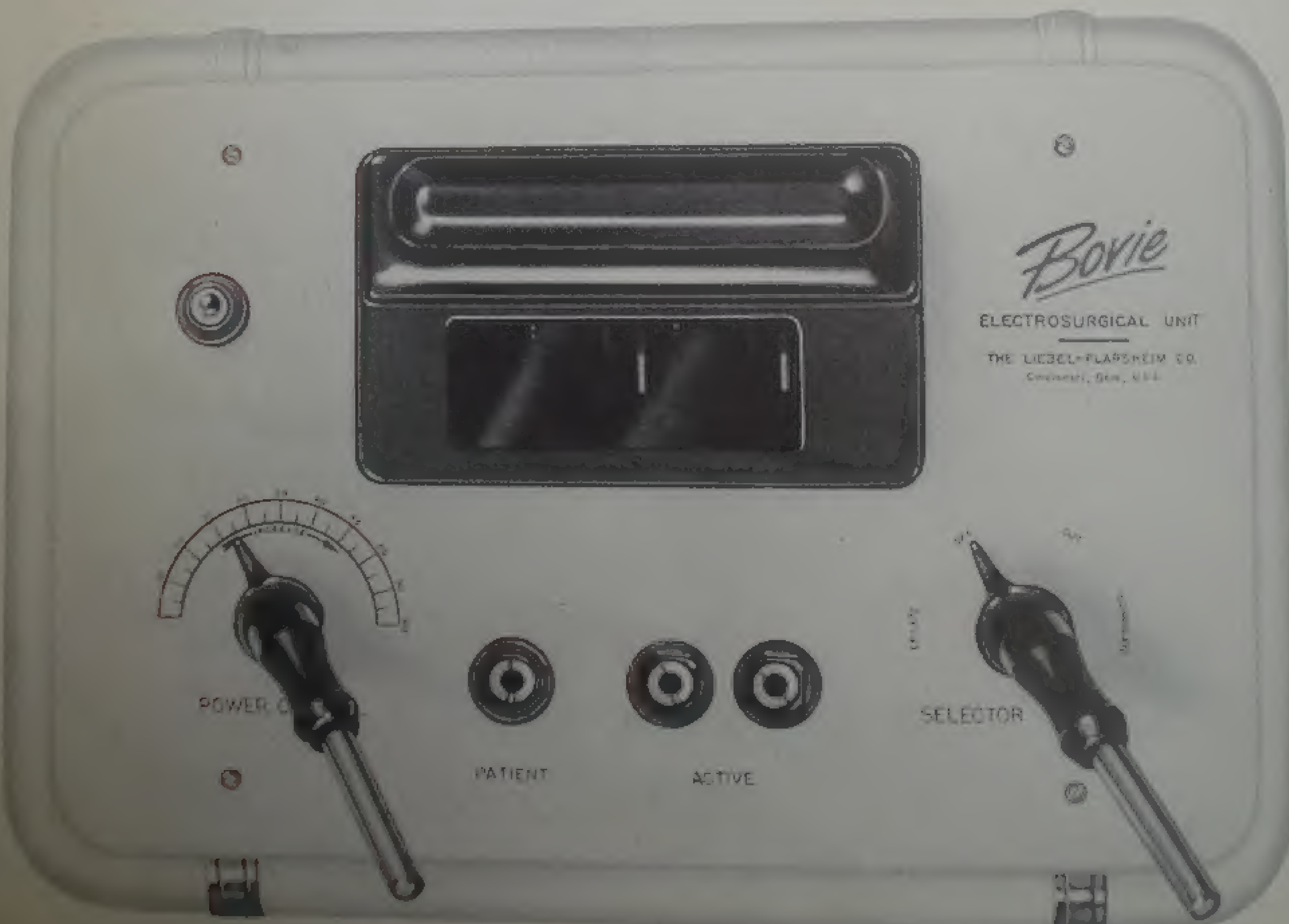
Fortunately, there is a simple remedy for this seemingly perplexing condition.

The thing to do is first, close all gaps completely by turning each adjustment knob clockwise until resistance is felt and further motion arrested. This may require anywhere from two to three, to thirty or more turns, depending on whether gap is partially open or closed at the start. Stops limit the number of possible turns in either direction and considerable resistance will be felt when this limit is reached. Don't attempt to turn knob BEYOND POINT WHERE RESISTANCE IS FELT. To do so might damage gap mechanism.

After all gaps are completely closed -- after all knobs have been turned clockwise until resistance is felt -- then open one gap at a time until it starts firing. This will require from fifteen to twenty-five counter-clockwise turns. Then open the other gaps in the same manner until all are firing. After all gaps have started to fire they should be correctly adjusted in accordance with instructions in preceeding section.

(II)
DESCRIPTION OF CONTROLS

All operator controls, with the exception of the footswitch, are located on the top panel of the unit.

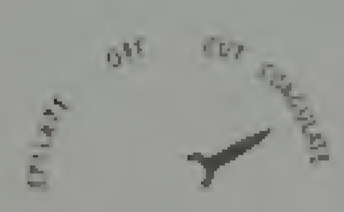


SELECTOR SWITCH

For ■election of Type of Current Desired

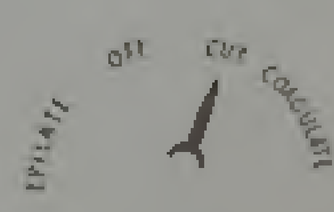
An important feature of this Bovie is the selector switch that is located on the right side of the control panel, as the operator faces the unit. This selector switch controls turning the machine on and off, as well as allowing complete freedom in selection of the type of current desired.

COAGULATE



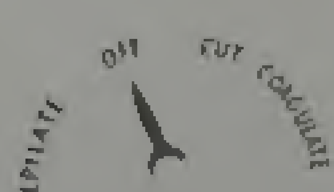
This setting delivers a highly damped current that is used for coagulation, fulguration, or desiccation.

CUT



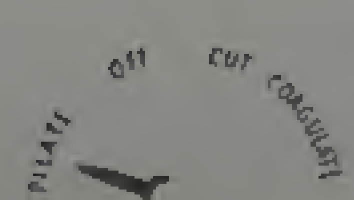
When the selector switch is set on this position, a moderately damped current is delivered which will allow for easy severance of tissue with a moderate degree of hemostasis associated with the cut.

OFF



With the selector switch at this position the machine is turned off.

EPILATE



This position of the selector switch causes the machine to deliver a very fine coagulating current that will allow the unit to be used for epilation and other types of surgery requiring small amounts of coagulation power.

POWER CONTROL

The power control is located on the left side of the control panel, when facing the unit. It provides for stepless control of the strength of current delivered to the operating electrode when the footswitch is depressed. The graduations shown on the dial are a relative measure of the power output.

PILOT LIGHT

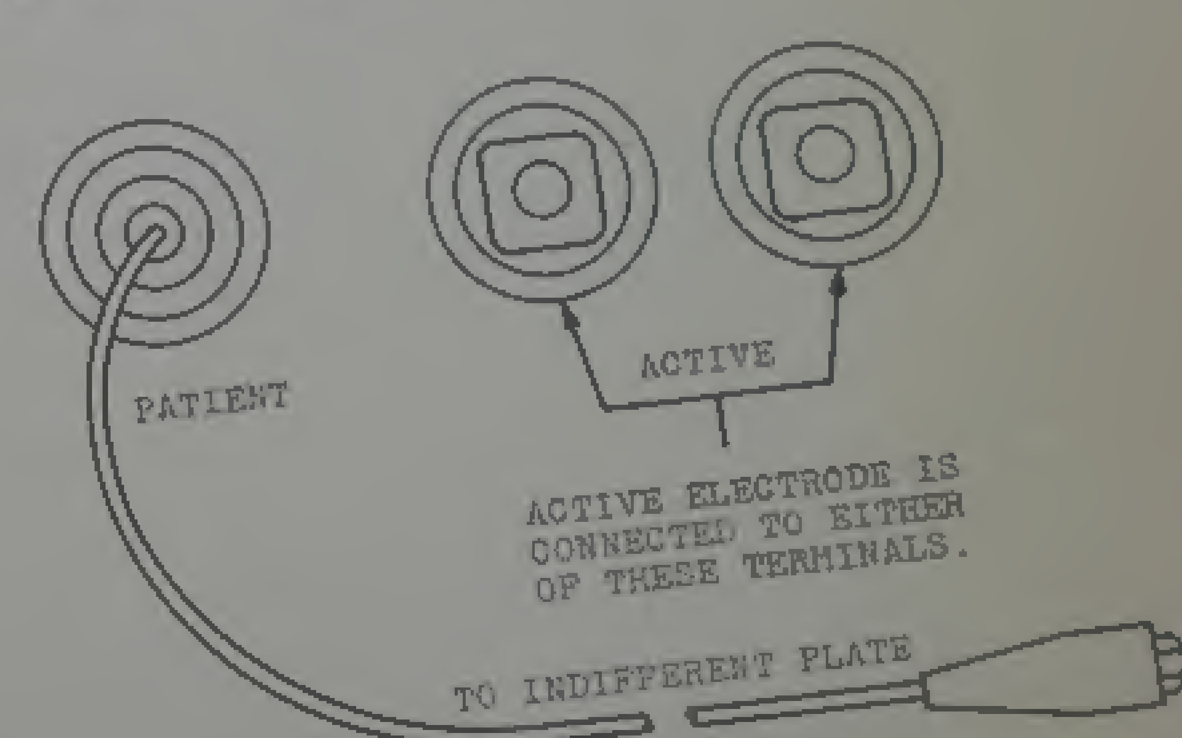
The pilot light is located in the upper left-hand corner of the control panel. The neon bulb will be lighted when the machine is set on either of the "On" positions; i.e., "Cutting" or "Coagulating".

FOOTSWITCH

The footswitch controls the delivery of current to the operating electrode. Depressing the footswitch causes the machine to deliver to the electrode the type of current that is called for by the setting of the selector switch.

TERMINALS

The terminals are located on the front of the control panel. The round receptacle on the left side marked "patient" is for insertion of the connecting cord to the indifferent plate.

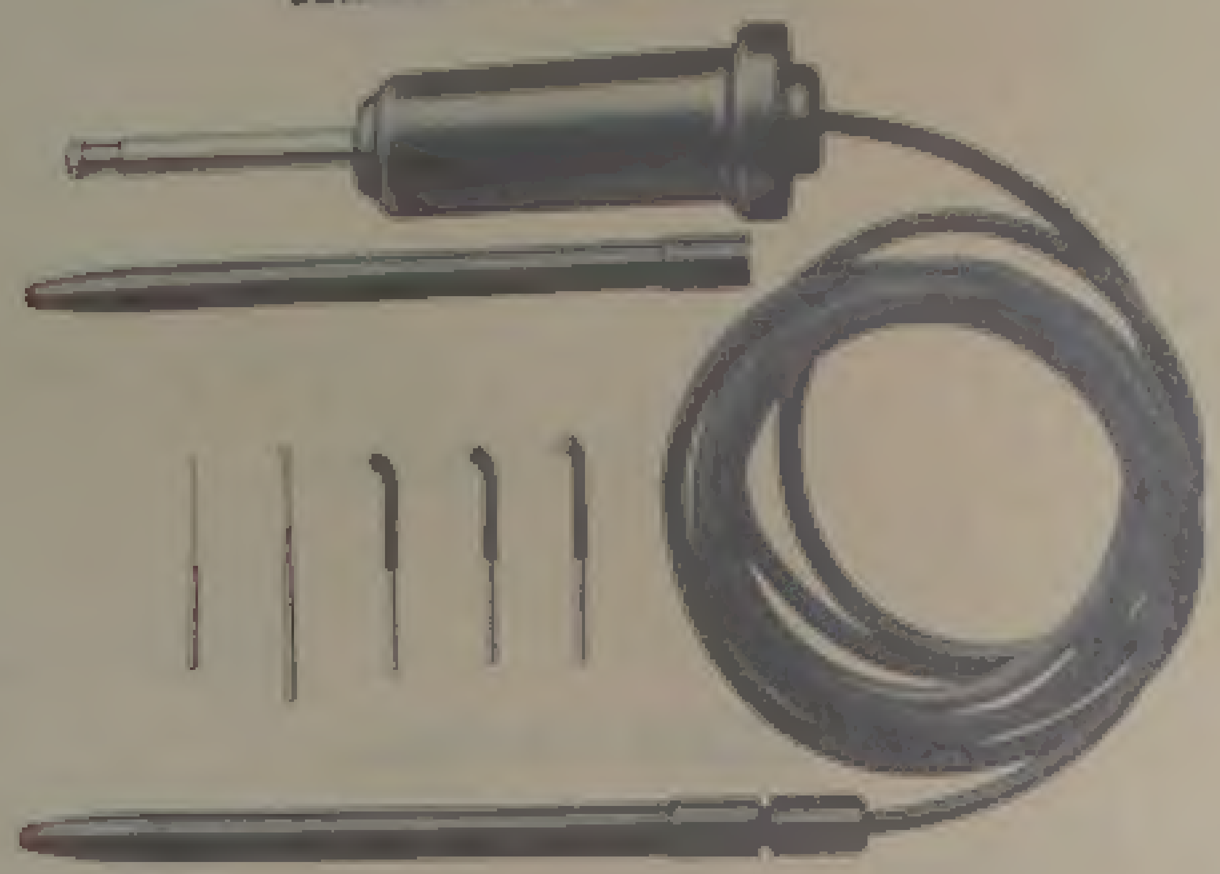


The active (operating electrode) is connected t
either of the two square receptacles mark
"active" The electrode terminals are con
nected together so that both deliver the sa
current, allowing two different operating ele
trodes to be connected simultaneously; and
the course of an operation, the surgeon can p
up the instrument desired at that moment.
"idle" electrode is placed in the instrum
rack. It must be remembered that the "i
electrode is "hot" when the footswitch is
pressed; therefore, care must be taken no
touch it while the other electrode is being u

There is no danger of improper conne
to the outlet terminals because the pa
electrode cord has a round plug, and a
electrode cords have square plugs. The
plugs will not fit the square receptac
vice versa.

ELECTROSURGICAL ACCESSORIES (Continued)

DETACHED RETINA ACCESSORIES



The Complete Kit

NOTE: The scalpel circuit of the Model "AG" Bovie and the Davis-Bovie units provides a special Retinal Detachment current with the Hemostatic Control Switch set on No. 4. The following electrodes are available for this technic:

No. 7512	Six-point Detached Retina Electrode on insulated, flexible extension shank.	becod	$5.00
No. 7513	One-point Detached Retina Electrode on insulated, flexible extension shank.	bedni	$2.75
No. 7516	Right-angle testing needle	begon	$1.50
No. 7518	Two-point Schoenberg hook	beite	$2.50
No. 7519	Adaptor with connecting cord and chuck handle	begot	$17.50

NOTE: WITH BOVIES OTHER THAN THE MODEL "AG" BOVIE AND THE DAVIS-BOVIE, IT IS NECESSARY TO USE A SPECIAL CURRENT ADAPTOR BECAUSE THE UNITS THEMSELVES DO NOT PROVIDE THE APPROPRIATE CURRENT FOR DETACHED RETINA. THIS ADAPTOR IS AVAILABLE AS A PART OF THE DETACHED RETINA KIT DETAILED BELOW.

DETACHED RETINA KIT

(Illustrated Above)

No. 7520 Detached Retina Kit for performing Retinal Detachment technic with Portable, Intermediate, Universal and Mobile Bovie Units, consisting of the following items in keratol-covered case:

No. 7520 Complete Kit . . . . bedom $35.00

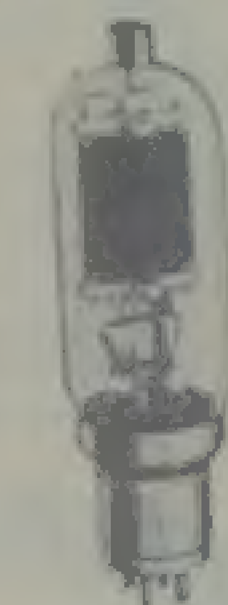
- 1 - Instruction sheet
- 1 - Adaptor with connecting cord and chuck handle
- 1 - Spare chuck handle sleeve
- 1 - Two-point Schoenberg hook
- 1 - Right-angle testing needle
- 2 - Single-point electrode with insulated flexible shanks
- 1 - Six-point electrode with insulated, flexible shank

TUBE REPLACEMENTS

for Model "AG" Bovie.

No. 8500 Type CV-II Tube for Model "AG" Bovie Unit only . . . . byag $10.00

THE ABOVE PRICE IS FOR TUBE REPLACEMENT AFTER 12 MONTHS FROM DATE OF INSTALLATION.



NOTE: Should the tube furnished with model "AG" Bovie fail under normal usage conditions before 12 months from date of installation, a replacement tube will be supplied upon payment by the purchaser of 1/12 the retail price of the tube for each month or part of the month the tube has been in service.

SPARK GAP REPLACEMENTS

Repairs on spark-gaps are handled on a replacement basis. When a spark-gap assembly is in need of replacement, send us the model and serial number of the Bovie Unit, when you order the new gaps. We will then ship the proper assembly on the plan stated below. The old gaps can be returned in the same shipping container.

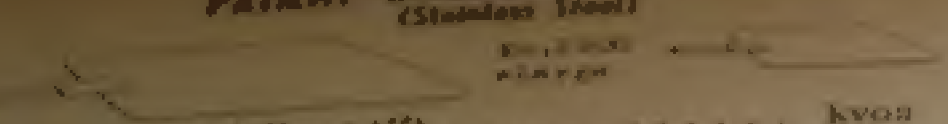
	List Price of New Assembly	*Credit for Return of Old As'mbly	Net Cost of Exchange
4-Gap CUTTING Gap Assembly (for Model AG Bovie Unit)	$115.00	$95.00	$20.00
4-Gap CUTTING Gap Assembly (for Davis-Bovie, Intermediate, Universal, 4-Gap Portable, Mobile Bovie) . . .	75.00	60.00	15.00
3-Gap CUTTING Assembly (for 3-Gap Portable, and Junior Bovie).	52.50	40.00	12.50
3-Gap COAGULATING Gap Assembly (for Davis-Bovie and Coagulator) .	35.00	25.00	10.00

* When the new gaps are sent out, a charge representing the complete cost is made. When old gaps are returned, a credit is issued, leaving only the net replacement charge as shown above.

PRICES LISTED ABOVE DO NOT INCLUDE PARCEL-POST CHARGES.

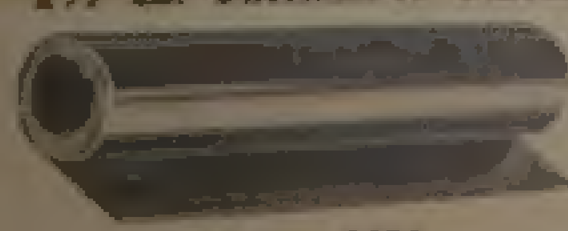
ELECTROSURGICAL ACCESSORIES (Continued)

PATIENT INDIFFERENT ELECTRODE
(Stainless Steel)



No. 2000 Large (9" x 14") .... kvoa $6.50
No. 2001 Small (6" x 7") .... kvow $4.50

2½ LB. DIATHERMY METAL



2005 2006

No. 2005 LIGHT WEIGHT, 12" wide, approx. 6 sq. ft. to roll, Gauge, .007" ...... eland $2.75

No. 2006 HEAVY WEIGHT, 12" wide, approx. 3 sq. ft. to roll, Gauge, .015" ...... elite $2.75

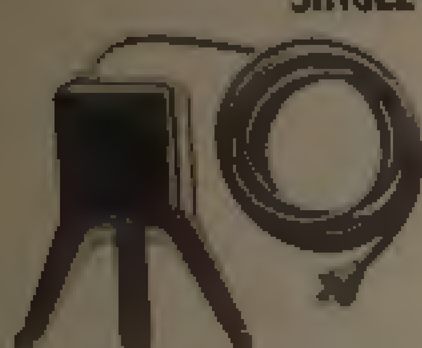
METAL ROLLER

2004

for smoothing out diathermy metal electrodes

No. 2004 .... effet $1.50

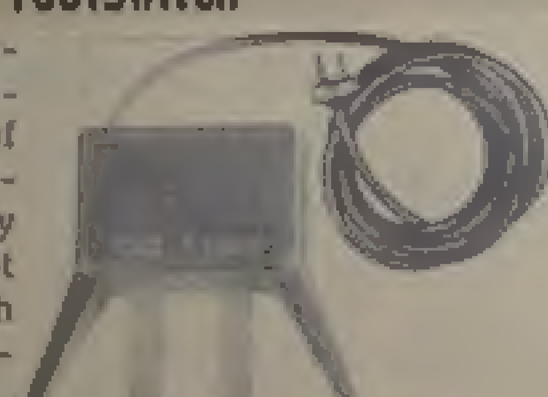
SINGLE-TREADLE FOOTSWITCH



One-piece shell, stainless, rust-proof alloy treadle. Rubber feet to prevent slipping on floor. Electrical parts completely insulated, shockproof. Will not short on wet floors. Complete with 8 ft. rubber covered cord and attachment plug.

No. 2015 .... escor $12.00

DOUBLE-TREADLE FOOTSWITCH

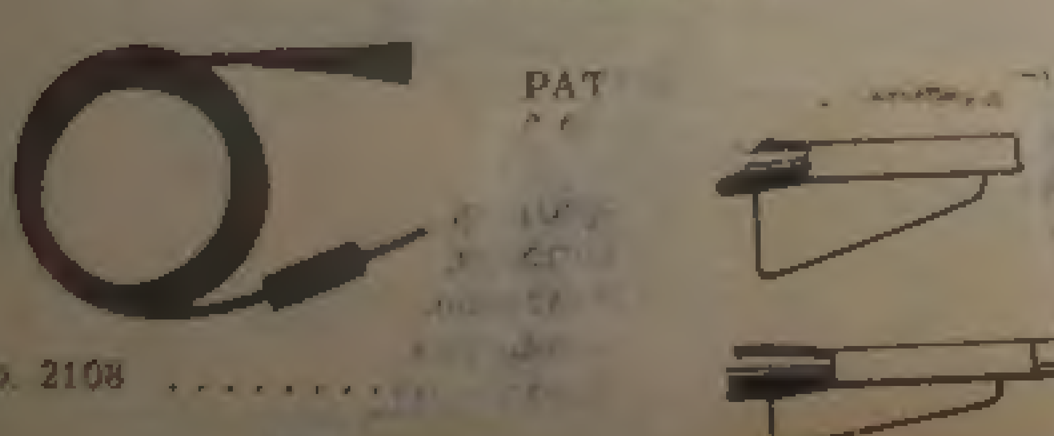


For use with Model "AG" and Davis-Bovie Electrosurgical Units. One-piece shell, stainless, rustproof alloy treadles. Rubber feet to prevent slipping on floor. Completely insulated, shockproof. Will not short on wet floors. Complete with 9 ft. rubber-covered cord and 3-prong attachment plug.

No. 2173 .... equal $25.00
No. 2177 SPECIAL DOUBLE-TREADLE FOOTSWITCH FOR "AG" BOVIE. Cord has twist-lock plug for use with "AG" Bovie .... equom $25.00

CONNECTING CORDS

Patient (Indifferent) Cord



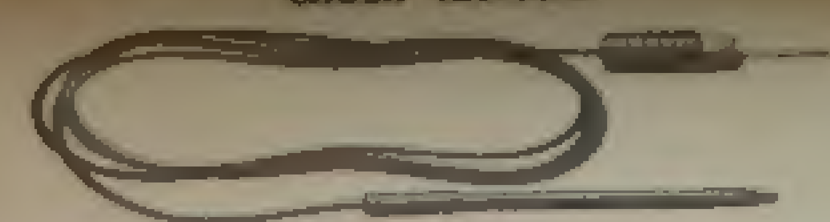
PAT... CORD, ...nd and ...Plug on

No. 2108 .... $2.50

ENDOSCOPIC ...

footswitch to machine and place it
ENDOSCOPIC C...ient spot for the surgeon.
6 ft. with insulat...
Bovie Plug. Used ... sterilized control handles
Endoscopic instrumen... the controls and give the
instrument or Fulgurate turns to lock them in
to Bovie Unit.
...ting electrodes into t...
...osening the chuck to r...
No. 2095 .... tighten carefully
in the instrumen...
...at the other en...
...inals of machine.

CHUCK HANDLES

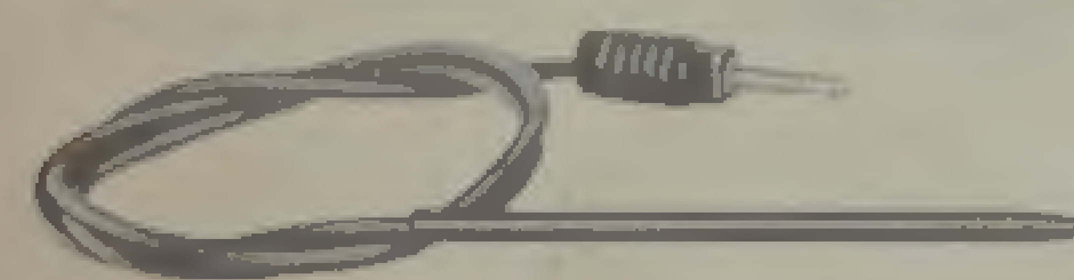


2073

SMALL CHUCK TYPE HANDLE

Moulded Bakelite handpiece. Small diameter affords easy manipulation. 6" long, 5/16" diameter. Easily taken apart for cleaning and sterilization. Complete with 6' rubber-covered cord and Bovie attachment plug.

No. 2073 .... faket $6.50



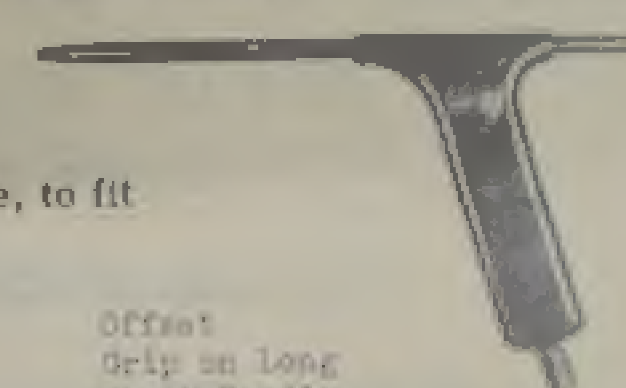
3450

LONG CHUCK TYPE HANDLE

(8-1/2"). Moulded bakelite handpiece. Screw on tip. Complete with 6' rubber-covered cord and Bovie attachment plug.

No. 3450 .... mecol $7.50

OFFSET GRIP FOR LONG CHUCK HANDLES



Offset grip as shown above, to fit long chuck handle.

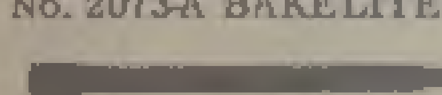
Offset Grip on Long Chuck Handle

No. 3428 .... medin $3.00

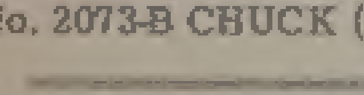
PARTS FOR CHUCK HANDLES

No. 3429 SPARE CHUCK TIP for long chuck handles. .... melga $ .85

No. 2073-A BAKELITE SLEEVE for small chuck-type handle. ... felao $1.65

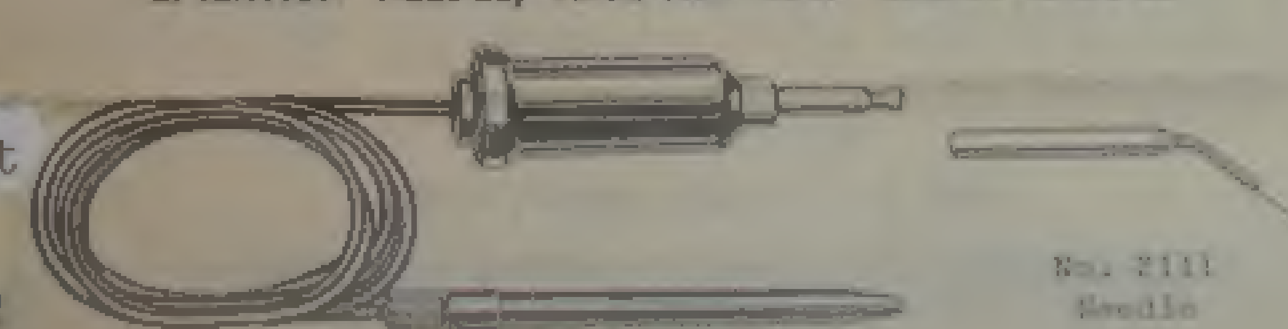


No. 2073-B CHUCK (Spring brass tubing for sleeve). .... foura $1.35



No. 2073-C CHUCK TIGHTENER (for small handle). ...... fueat $1.35

EPILATION NEEDLE, ADAPTOR AND CHUCK HANDLE

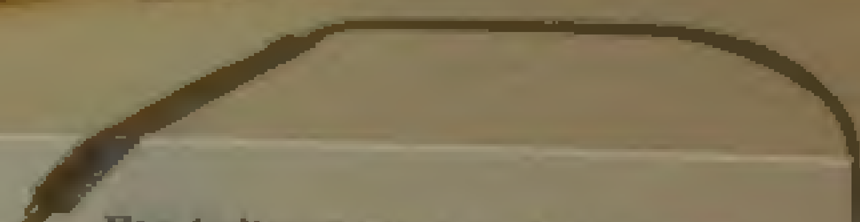


No. 2111 Needle

No. 2112 Adaptor and chuck Handle.

No. 2111 Epilation Needle, Angulated ..... epill $ .75
No. 2112 Epilation Adaptor with chuck handle. (Reduces power output for precise power settings) ..... epoa $17.50

CURVED LARYNGEAL COAGULATION ELECTRODE

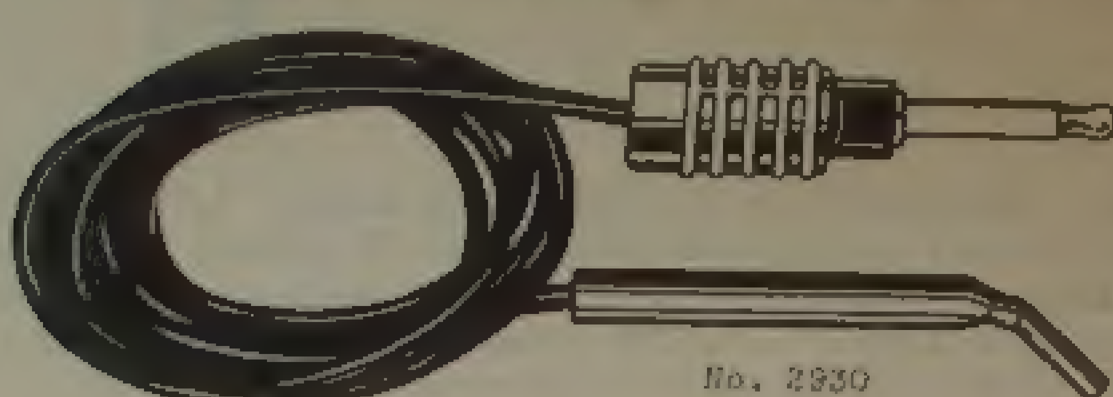


For indirect work under mirror.

No. 2114 . . . . enigm $12.50

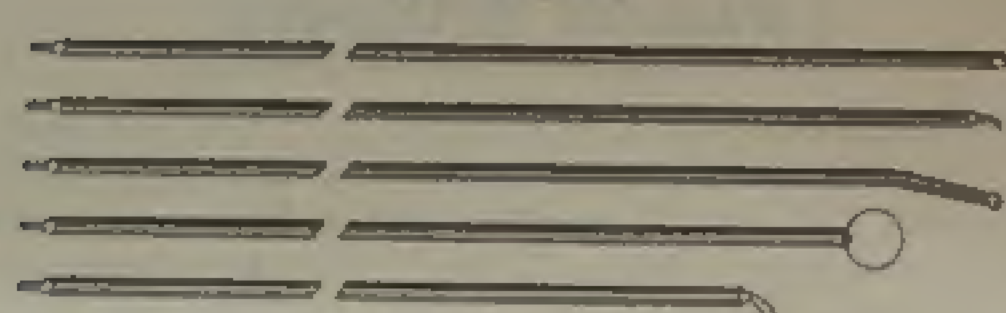
SPECIAL LONG-SHAFT ELECTRODES WITH OFFSET HANDLE

For larnygeal, Bronchial, Esophageal or Proctologic Use



No. 2930

TIP STYLES



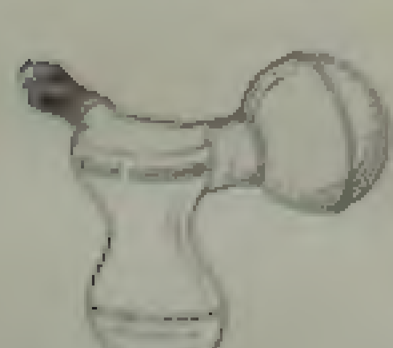
(1)
(2)
(3)
(4)
(5)

No. 2930	Handle with angle bend to accomodate all shafts illustrated. Complete with attached connecting cord and Bovie plug	friol	$7.50
No. 2931	6'' shaft, with tip 1, 2, 3, 4 or 5 (Specify tip).	friom	$4.00
No. 2932	9'' shaft, with tip 1, 2, 3, 4 or 5 (Specify tip).	frior	$4.50
No. 2933	12'' shaft, with tip 1, 2, 3, 4 or 5 (Specify tip).	frios	$5.00
No. 2934	15'' shaft, with tip 1, 2, 3, 4 or 5 (Specify tip).	friot	$5.50
No. 2935	18'' shaft, with tip 1, 2, 3, 4 or 5 (Specify tip).	frioy	$6.00
No. 2936	24'' shaft, with tip 1, 2, 3, 4 or 5 (Specify tip).	frioz	$6.50

RESECTION LOOPS

(Specify Standard or Convertible)

No. 2139	Loop for 24 Fr. Electrotome, Size #12 (.012'' wire).	awacy	$5.50
No. 2140	Loop for 24 Fr. Electrotome, Size #15 (.015'' wire).	awbel	$5.50
No. 2141	Loop for 28 Fr. Electrotome, Size #12 (.012'' wire).	awcup	$5.50
No. 2142	Loop for 28 Fr. Electrotome, Size #15 (.015'' wire).	awdde	$5.50

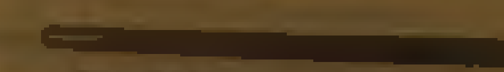


ELLIK EVACUATOR

No. 2170 Ellik Evacuator

azeel $7.50

BI-TERMINAL, CERVICAL, TONSIL AND TURBINATE COAGULATION ELECTRODES



No. 2166 Handle

ELECTRODE HANDLE with cords and plugs. (Can be fitted with cervical, tonsil, or turbinate electrodes.)

No. 2166 . . . . elaby $7.50

No. 2167 Cervical Coagulation Electrode

No. 2167 CERVICAL COAGULATION ELECTRODE . . . . emuob $7.50

No. 2168 Tonsil Electrode

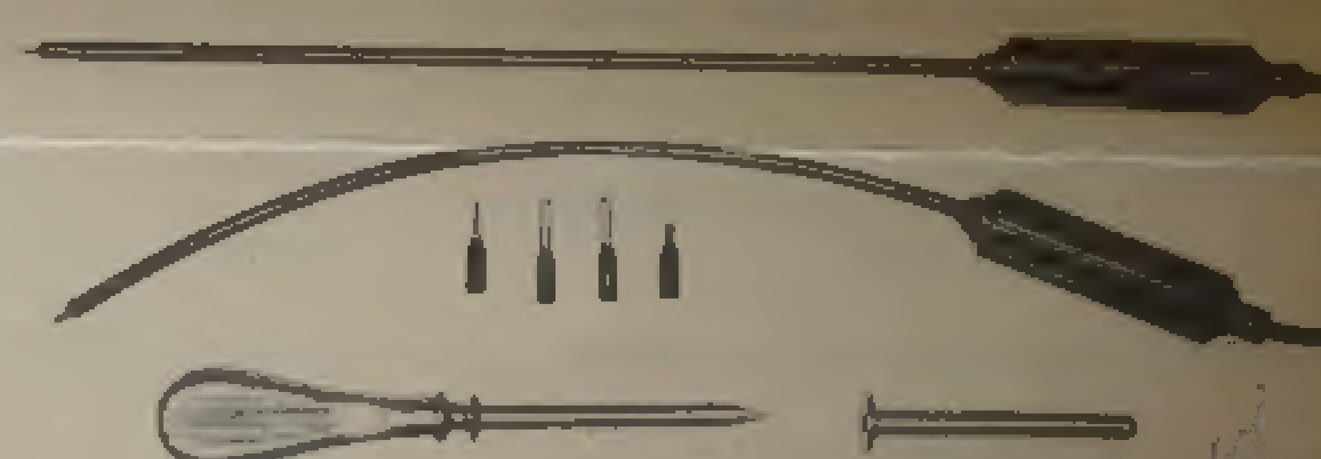
No. 2168 TONSIL ELECTRODE. . . . . eourt $7.50

No. 2172 Turbinate Electrode

No. 2172 TURBINATE ELECTRODE. . . . . . equel $7.50

INTRA-PLEURAL PNEUMOLYSIS OPERATING INSTRUMENTS

FOR CUTTING ADHESIONS IN ARTIFICIAL PNEUMOTHORAX



(Partial view; complete set listed below.)

Dr. Julian A. Moore's INTRATHORACIC OPERATING INSTRUMENTS, complete set consisting of: 1 straight handle, 1 curved handle, 1 point, 2 blades, 1 ball,2 flexible cannulae, 1 torcar, 2 high-frequency cords with attachment plugs, complete set in wooden carrying case.

No. 7600 . . . . agate $80.00

DR. MOORE'S IMPROVED THORACOSCOPE

No. 7603	Dr. Moore's Improved Thoracoscope, with light cord and one spare lamp	agult	$130.00
	SPARE LAMP FOR ABOVE.	agsel	2.25

INDIVIDUAL PRICES

Dr.Moore's Intrathoracic Operating Instruments

No. 7612	Straight Handle and Cord	afeap	18.50
No. 7613	Curved Handle and Cord.	agulo	18.50
No. 7614	Flexible Cannulae	ahiml	6.00
No. 7615	Trocar.	ajult	6.00
No. 7616	Ball electrodes.	akand	3.50
No. 7617	Point electrodes	alami	3.50
No. 7618	Blade electrode.	amour	3.50
No. 7619	Wooden carrying case	accul	7.50
No. 7620	Pneumolysis Cord with fitting for handle and Bovie attachment plug.	apurf	3.00

principles are [illegible] will have little difficulty in [illegible] setting for different types of work.

Cutting power required will vary depending on -- (a) nature of tissue [illegible]. Fat or cartilage require [illegible] than skin or muscle. Sclerotic, fibrotic, or cicatricial tissues will require more power than other tissues. (b) depth of incision. A deep incision (with the same electrode and a given speed of cut) requires more power than a shallow one. (c) rate of speed at which cutting electrode is moved. Fast cuts require more power than slow. (d) type of electrode used. For a given depth of incision with equivalent speed of cutting, the amount of power required will depend on the thickness of the electrode used. The thinner the electrode, the less power required.

Coagulation power required will also vary according to -- (a) time current is applied. Contrary to what might be expected, a lower power for a longer time will give greater depth of coagulation, than will a high power setting for a shorter time. (b) type of electrode used. A heavy electrode (i.e., ball or disc) will require a higher power setting than pointed electrodes.

With these fundamentals in mind, it can be seen that power settings given, while reliable figures, are subject to individual variation. The surgeon should learn that this is a variable factor and that best results are obtained by varying the power setting to meet the immediate conditions.

If the lowest possible power setting is used which will allow the electrode to cut freely at the desired depth, there will be a minimum of sparking and fulguration of the electrode, which will prolong the life of the operating instruments, and will prevent charring and excessive coagulation of the wound edges.

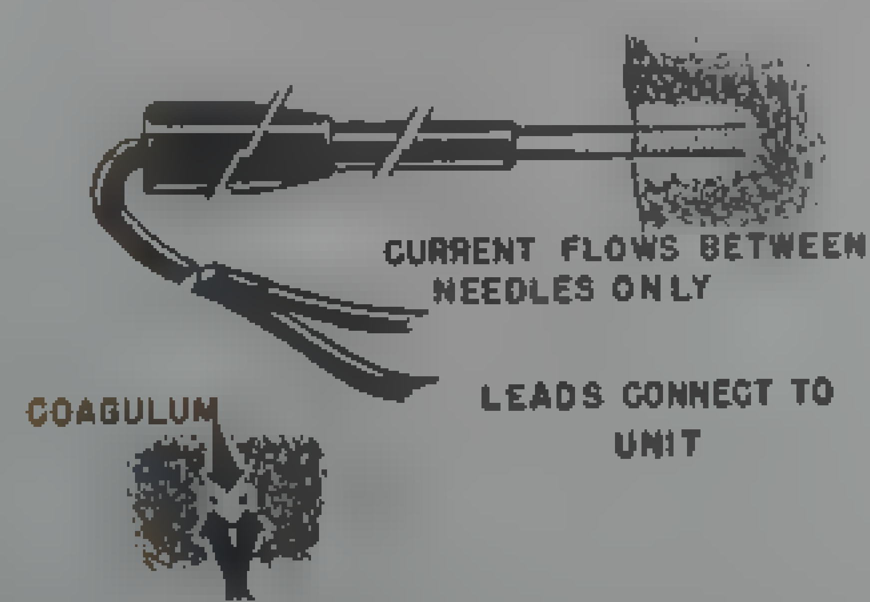
IMPORTANT

Certain general precautions are necessary in the use of any electrosurgical unit. In Section V following, the precautions applying to this model Bovie are set forth. Read and observe them carefully.

(IV)

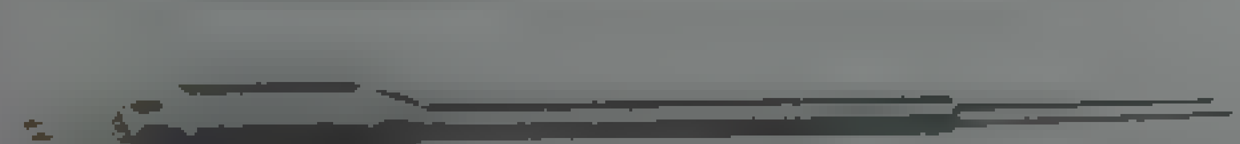
SPECIAL TECHNIQUES

COAGULATION WITH BITERMINAL ELECTRODES



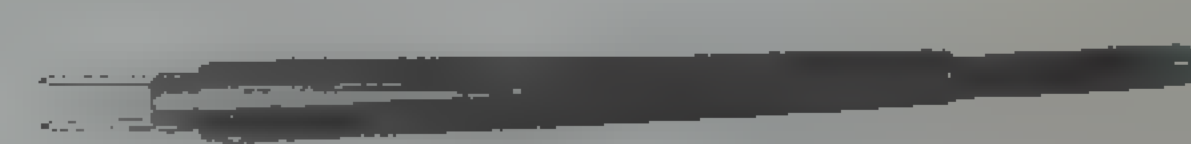
In recent years there has been a steadily increasing use of the so-called biterminal coagulation electrodes. In these instruments there are two needles or points, each connected to one of the terminals of the Bovie. No indifferent electrode is used as the two points are each, in effect, active electrodes. Coagulation takes place only between and around the two needles. While made in a variety of designs, the tonsil, cervical, and turbinate electrodes, as illustrated, are the ones most extensively used.

BITERMINAL TONSIL ELECTRODE



BITERMINAL TURBINATE ELECTRODE

Only a small amount of power is required when using biterminal electrodes as the current penetrates only the tissue laying between and immediately around the needles. Extreme care must be taken to avoid an excess of power so that arcing between the points or a breakdown within the handle will not occur.



BITERMINAL CERVICAL COAGULATION ELECTRODE

The biterminal cervical coagulation electrode consists of an insulating tip with two narrow metal plates at each side, which constitute the active electrodes. The tip is passed into the cervical canal, the current turned on and the electrode rotated through one half turn, which results in coagulation of the endo-cervical tissues -- the depth of destruction depending on the amount of current used and speed of rotation.

EPILATION

The Model "0-3" Bovie incorporates a special circuit for epilation. Selector switch should be set on "epilate" and the standard chuck plugged into either of the active electrode receptacles. It is advisable to use the convenient 5" x 7" inactive electrode. The patient merely places her hand on the electrode and then rests the weight of her body on the hand to insure good contact. Power control settings will vary between 40 and 60 depending on depth of the follicle and diameter of the hair.

The special angulated epilation needle will easily slip into the follicle under magnification for good visability. The needle should be inserted into the follicle for a distance of about 3/8" and the footswitch depressed for about two seconds. Frequently the hair will slip out when the needle is withdrawn, or it may need slight traction with forceps.

Using the above procedure the physician can remove 80 to 100 hairs per hour. It is advisable not to work in too small an area at any one time to reduce the possibility of scar formation.

(V)

GENERAL PRECAUTIONS

THE ANESTHETIC

Most procedures will not require any anesthetic other than local; but should a general anesthetic be necessary, please consider the suggestions to follow.

The use of an electrosurgical apparatus imposes some limitations on the type of anesthetics which can be safely used. Choice of anesthesia should be made with full consideration of the danger of using electrical sparks in the presence of explosive gases.

The best rule is to avoid <u>all</u> inflammable anesthetics; and it should be recognized that all commonly used inhalant anesthetics <u>are</u> inflammable -- especially so when used with oxygen.

With present-day techniques of administering spinal, intramuscular, oral and rectal anesthetics, the surgeon or anesthetist has a wide choice from which to select an appropriate anesthesia for any electrosurgical procedure.

Even so, some surgeons and anesthetists consider nitrous oxide safe enough if the operating field is remote from the respiratory passages; or, even chance ether by the closed method with such precautions as continuous ventilation of the operating room, moist drapes separating the patient's head and the anesthetist from the operating field, exercise of care to avoid any spillage and prompt removal of empty ether cans from the room. It goes without saying, of course, that no inhalent of even the slightest degree of inflammability should be used if there is or can accidentally be any communication between the operating field and the respiratory system.

GROUNDING UNIT

Be sure that the unit is grounded in accordance with grounding instructions given in Section I. Otherwise, there is a possibility of shock to patient or operator -- remote but real.

CHECKING CORDS, CONNECTIONS

It is important that all cords and plugs be frequently checked for breaks in insulation or electrical contact. When plugs are pulled out of receptacles, grasp the plug, not the cord. Jerking on the cords may pull soldered connections loose, age and repeated sterilization can cause cracks in rubber insulation which might result in burns to patient or operator.

Always use an individual electrical outlet. Do not connect the Bovie to the same outlet with other appliances.

PREVENTION OF HIGH-FREQUENCY SKIN BURNS

Accidental burns are possible either from the indifferent electrode (if improperly prepared or applied) or from the active electrode if it is carelessly handled or laid on the patient when not in use.

The indifferent electrode must be kept <u>clean</u> and smooth and should be applied with a generous application of heavy soap lather or K-Y jelly. Under no circumstances should the plate be applied over hair or hard scar tissue.

When not in use, the chuck handle and active electrode should be placed in the instrument rack. If more than one active electrode handle has been connected to the unit, it must be remembered that all connected electrodes are "hot" when the footswitch is depressed. Therefore, "idle" electrodes should be safely kept in their proper place on the instrument rack.

PREVENTION OF BURNS RESULTING FROM ACCIDENTAL IGNITION OF INFLAMMABLE FLUIDS

When an inflammable fluid, such as alcohol or ether, is used to cleanse the field preparatory to surgery, it is important to remember that there is a possibility of igniting any gas or residual liquid by a spark from the electrode. When inflammable fluids or solvents are used, allow sufficient time for <u>complete</u> evaporation and be sure that drapes, dressings, coverings, clothing, etc., surrounding the field are thoroughly dry and not saturated with the liquid.

SEE GENERAL CAUTIONARY STATEMENT ON PAGE 10

(VI)

SERVICE NOTES

The Bovie will require very little servicing except that occasioned by the normal wear on the spark gaps and rubber parts of the cords.

Excessive heating or exposure to ultraviolet will cause deterioration of the rubber insulation on the electrode cords. Care should be taken not to pull on the leads to disconnect them from the machine but, rather, to grasp the terminal plugs.

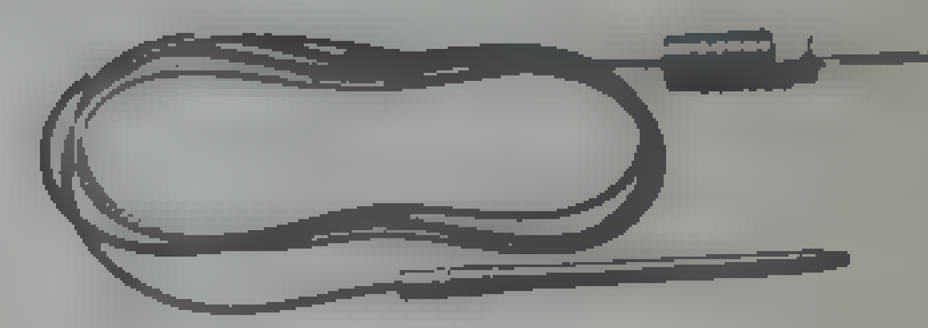
After a great deal of use the tungsten surface of the gaps will become carbonized and pitted so that they cannot be accurately adjusted. If gaps are properly set, this should not occur oftener than every few years under normal usage.

When it is necessary to replace gaps, your local Liebel-Flarsheim salesman, or the factory, should be contacted. A factory rebuilt set of gaps will be sent to you with complete instructions for replacing the old gap assembly. The old gap assembly should be returned to your dealer, or the factory, in the shipping container in which the new gaps were received. There is a nominal charge for this replacement service.

[illegible]

ABOUT THE ACCESSORIES

FOR THE ORDINARY ELECTROSURGICAL TECHNIQUES which do not require specialized instruments -- such as general surgery, neurosurgery, gynecological or tumor surgery, this Bovie comes equipped with a "Standard Set of Surgical Accessories" comprising chuck handles to hold the various electrodes and a generous assortment of cutting and coagulation tips. There are two types of chuck handles furnished -- the standard small chuck handle (illustration A) and the "long" chuck handle (illustration B) which may be used with the offset grip for visual accessibility through small orifices.

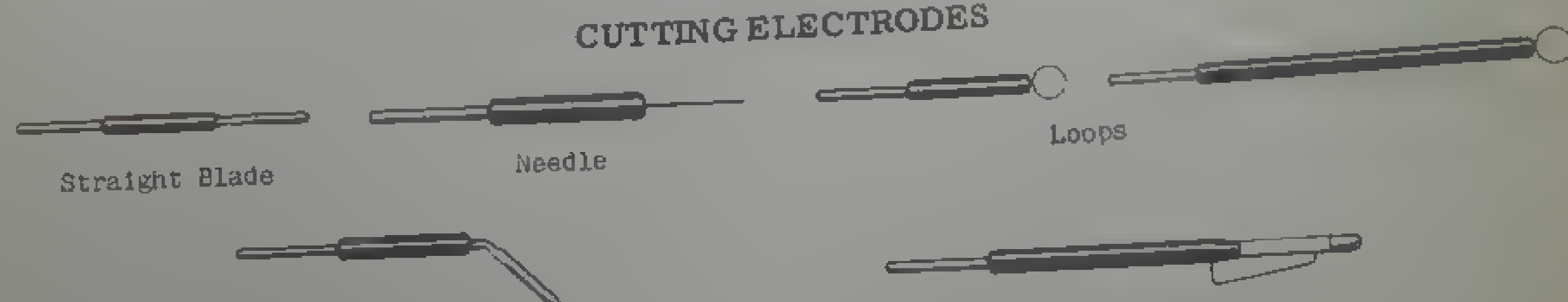


SMALL CHUCK HANDLE
ILLUSTRATION A

LONG CHUCK HANDLE
ILLUSTRATION B

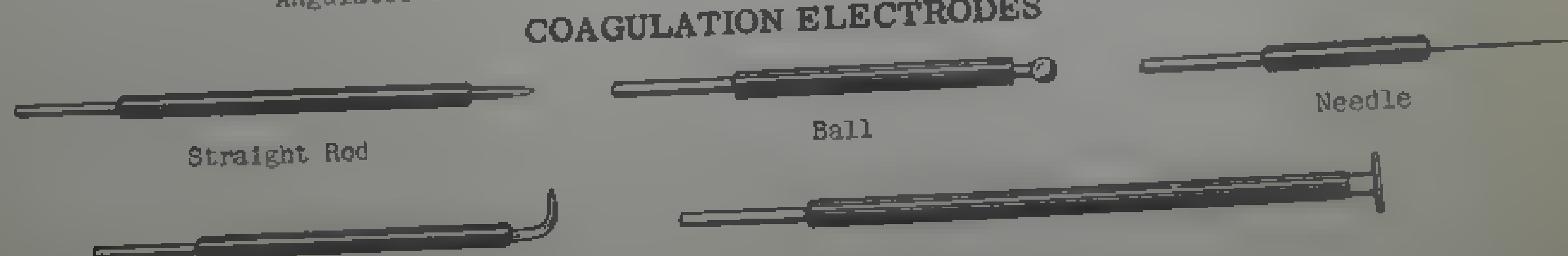
The electrodes furnished with the standard set of surgical accessories are of the following types:

CUTTING ELECTRODES



Straight Blade — Needle — Loops — Angulated Blade — Conization Electrode

COAGULATION ELECTRODES



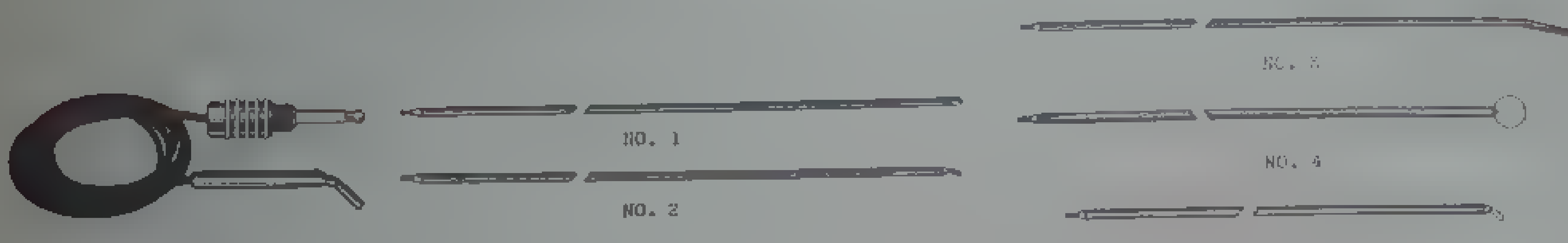
Straight Rod — Ball — Needle — Curved Rod — Disc

See next page for Special Electrodes

SPECIAL ELECTRODES

[illegible]

LONG-SHANK ELECTRODES (6" to 18" lengths)



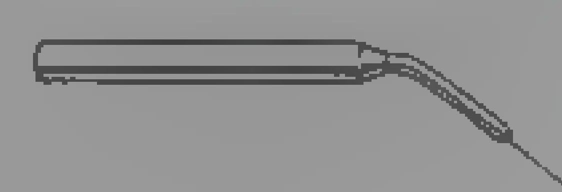
Handle

Tips, 1, 2, 3, 4, and 5.

CURVED LARYNGEAL ELECTRODE

For indirect work under mirror.

EPILATION NEEDLE



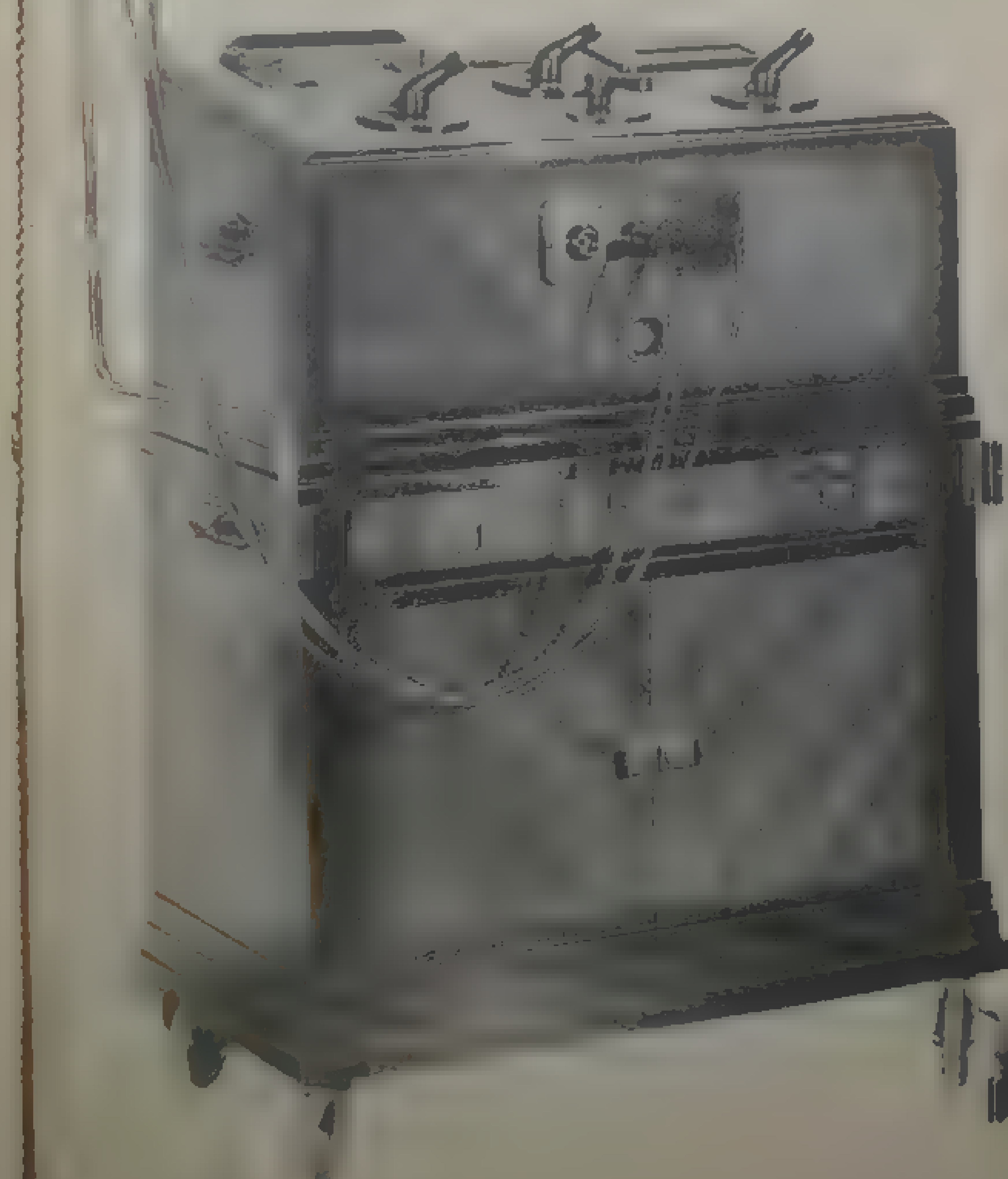
CAUTION

CAUTION: This Bovie Electrosurgical Unit is sold only for use by qualified physicians and surgeons. The observance of safe and established medical practices is essential to its proper use, otherwise there are possibilities of injury to patients or operators.

Instructions for Connecting and Operating

THE IMPROVED DAVIS-BOVIE ELECTRO-SURGICAL UNIT

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO USE THE MACHINE. SPARK GAP ADJUSTMENT IS THE MOST IMPORTANT FACTOR IN PREPARING THE DAVIS-BOVIE FOR SERVICE. ADJUST GAPS CAREFULLY AS OUTLINED ON PAGE 4



INDEX

The Liebel-Flarsheim Co.
Cincinnati, Ohio, U. S. A.

Instructions for Connecting and Operating The Improved Davis-Bovie Electro-Surgical Unit

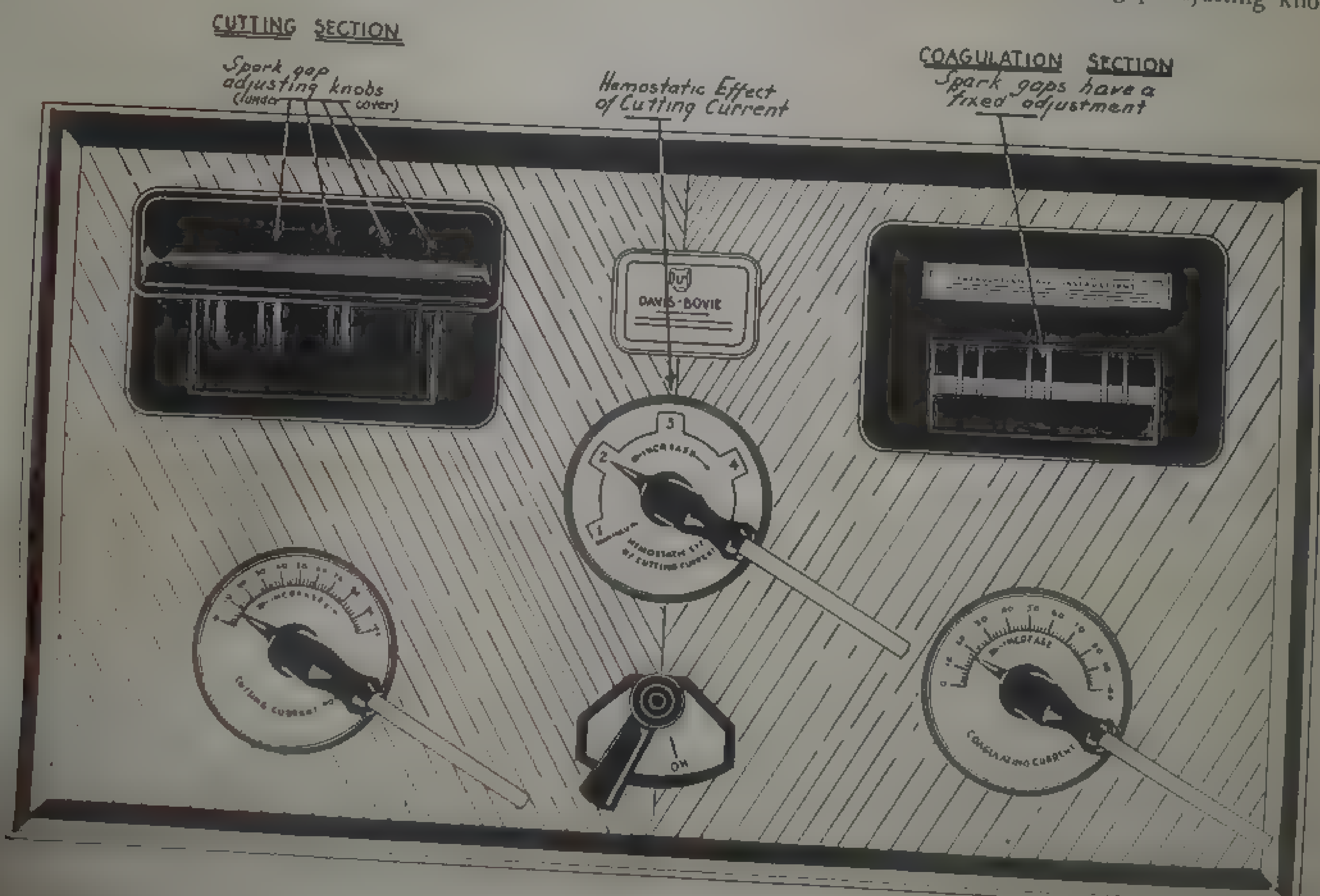
After uncrating the apparatus we suggest checking accessories with the accompanying "Accessory List" to see that all items are duly received. All accessories and the sterilizable instrument rack are packed in the sub cabinet.

Unless otherwise marked on rating plate (at back of cabinet) this machine is for operation on 115 volts 60 cycles *alternating current.* Consult your electrician and make sure correct current is used. Have fuses of adequate capacity installed on the line before turning on the machine.

General Description

The Improved Davis-Bovie Electro-Surgical Unit is a single cabinet containing two entirely separate electrical circuits. One delivers high frequency CUTTING currents, the other an entirely different type of current for COAGULATION, DESICCATION and FULGURATION. The two circuits are electrically independent, but by means of an electro-magnetic current selector, controlled by a double-treadle foot switch, either current can be instantly connected to the outlet terminals and through these to the operating electrodes. To connect either current to the instrument, simply press proper pedal on double treadle foot switch. The LEFT hand treadle controls the CUTTING current, the RIGHT hand treadle the COAGULATING current. For convenience we will refer to these two parts of the machine as the "Cutting Section" and the "Coagulation Section."

Facing the cabinet, the Cutting Section with its power control lever and spark gap adjusting knobs



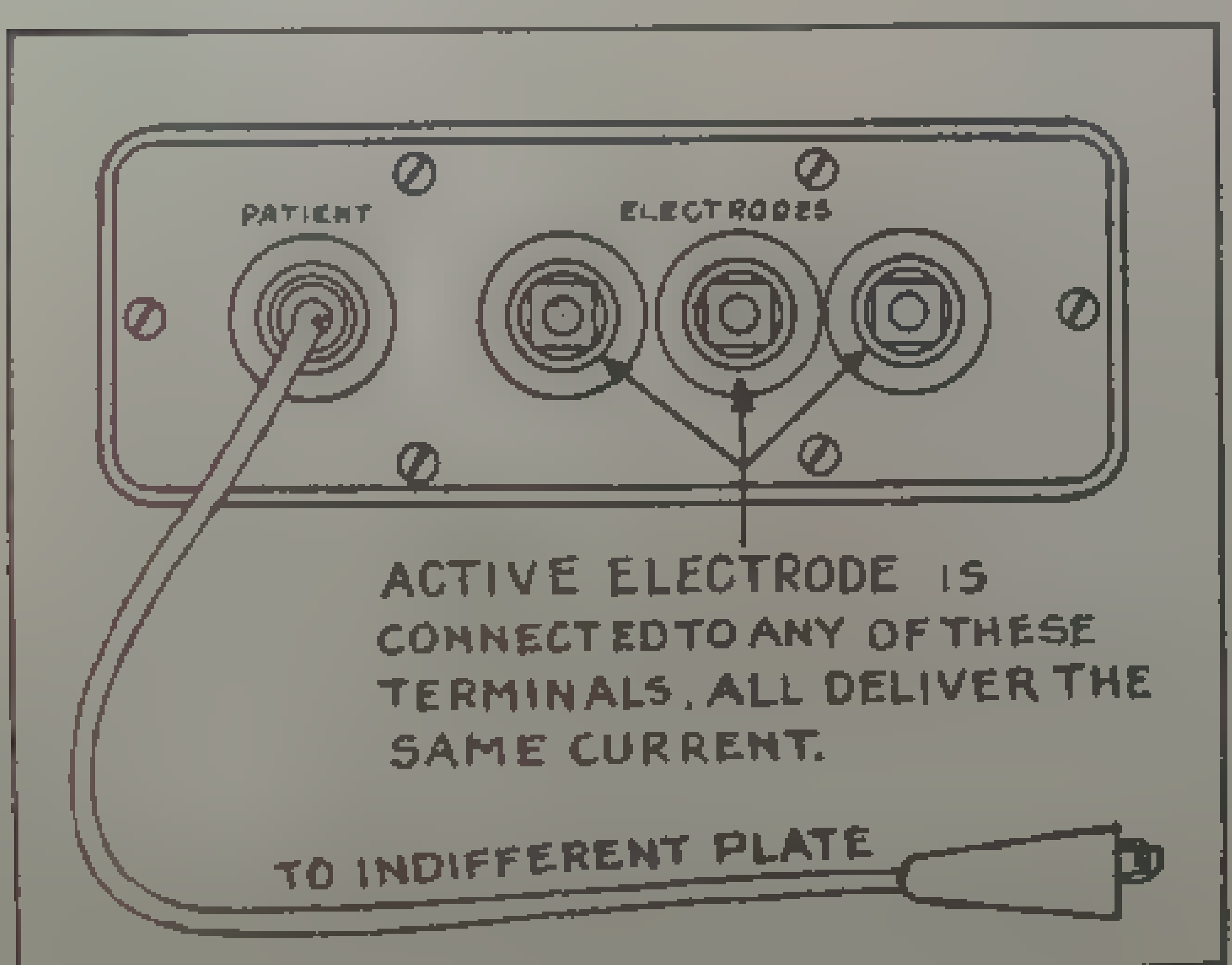
is at the left. The Coagulation Section, with its single power control lever and fixed spark gap is at the right.

At front center on top panel is the "Main Switch" for turning the machine on and off.

Immediately above the "Main Switch" is a control designated "Hemostatic Effect of Cutting Current," which governs the degree of hemostasis (dehydration) produced by the *cutting current* on the wound edges. *Carefully study separate section relating to the use of this control.*

Below, on the front panel is a pilot light which glows whenever unit is connected and Main Switch turned on, showing the machine is ready for use, but no high frequency current is generated until foot switch is depressed.

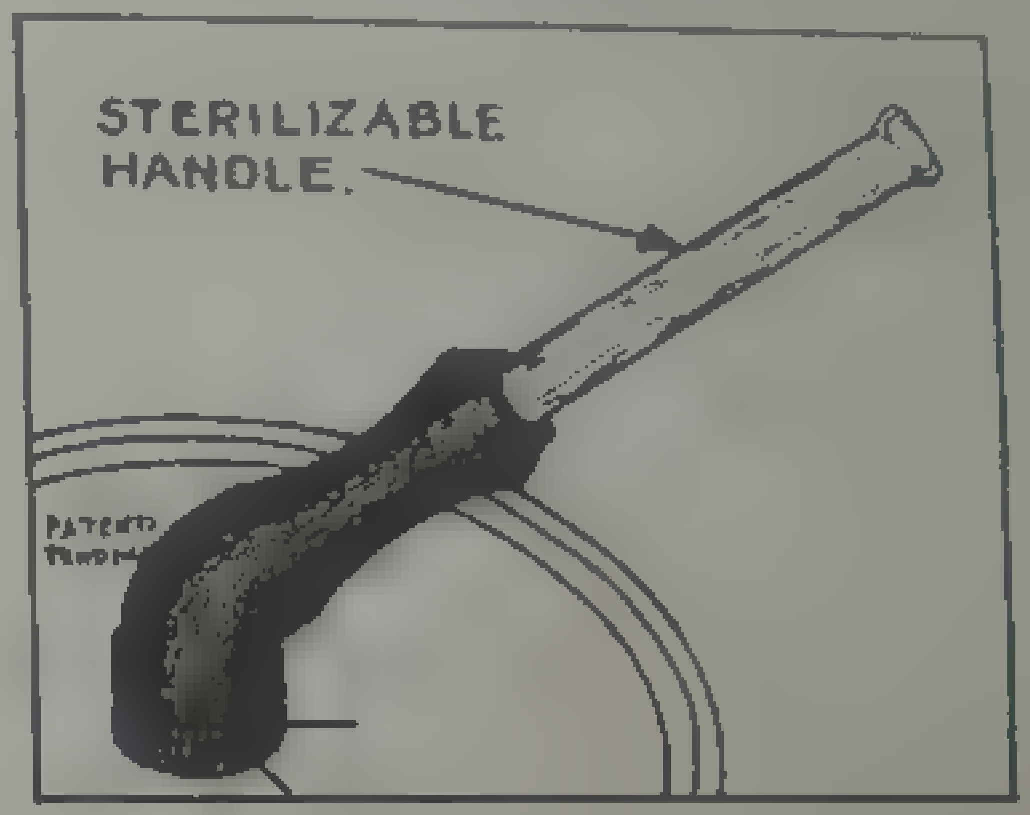
Immediately above the pilot light are four high frequency current connections of the plug-in type. The inactive (indifferent) electrode is connected to the single terminal, at left, marked "Patient." The active (operating) electrodes are connected to any of the three terminals marked "Electrodes." These



terminals are in multiple and all deliver the same current. Three are provided so that up to three different operating electrodes can be connected simultaneously and in the course of an operation, the surgeon can simply pick up the instrument desired at the moment. Inactive (patient) electrode cord is equipped with a round plug; active electrode cords are equipped with square plugs so that they cannot be connected to the wrong terminal.

On the back of the cabinet are connections for the electrical current (marked "Supply Plug") and for the foot switch.

On each front corner of the sub-cabinet are small metal brackets for supporting the sterilizable instrument rack which can be mounted at either corner to best suit the operator's convenience.



Sterilizable Instrument Rack consists of four separate pieces, the rack proper and three sections of supporting standard, two straight sections and one curved at each end. When used for major surgery this entire rack assembly may be sterilized by boiling or auto-claving and fastened to the machine. The curved section should be inserted in bracket and fastened with set screw. If the instrument rack is too high for convenience with both straight sections in place, leave off one length, or both.

Sterilizable Handles are provided for the three control levers. They are locked in the levers by turning each two or three times in a clockwise direction, screwing it in place.

At the back of the sub-cabinet is a special compartment that is convenient for storing the foot switch and supply cable.

To Place Machine in Operation

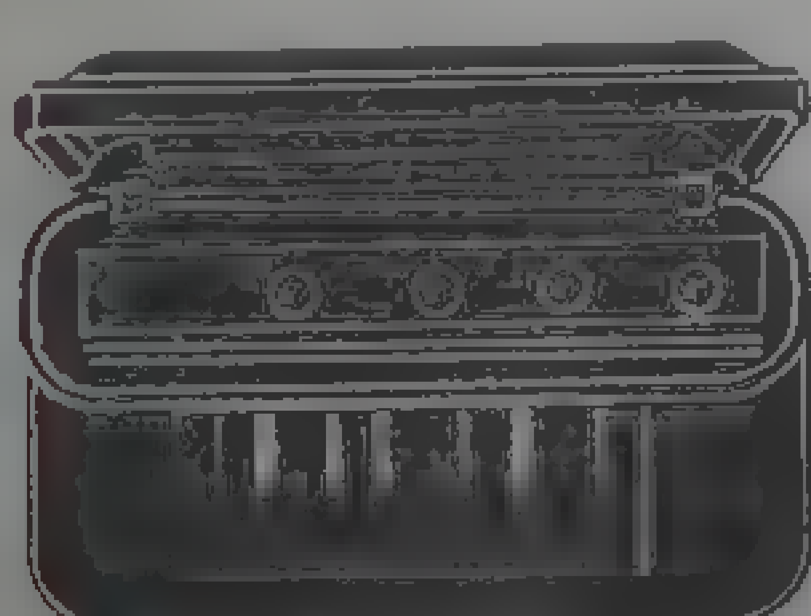
To prepare the Davis-Bovie Unit for use requires merely that the machine be connected to the proper current supply, the foot switch connected, spark gaps on cutting section correctly adjusted, and the various controls properly set. It is extremely important that the cutting current spark gaps be correctly adjusted prior to each operation, as covered in detail in a

subsequent section. The gap setting on the coagulation section is fixed. We suggest that the various steps be carried out in the following sequence.

1—Connect Foot Switch and Supply Cable. Be sure your electrical current is of the proper voltage and frequency. Unless otherwise noted on rating plate at back of cabinet, the Davis-Bovie Unit is designed for operation on 115 volts, 60 cycles, alternating current. Special models for operation on other alternating currents are so marked on the rating plate. When only direct current is available a rotary converter must be used. Make sure the fuses on your supply line are heavy enough to carry the machine in addition to any other load on the line at the same time. Refer to the rating plate on back of cabinet for current (amperes) of your machine.

2—Turn Main Switch to "On" Position.

3—Adjust Cutting Section Spark Gaps as follows: Cutting section spark gaps are below the glass window at the left. Firing of the gaps may be observed through the window. Immediately above the window is a hinged cover, which when turned back, exposes the four gap adjustment knobs. Each knob governs the adjustment of the individual gap below it. Turning the knob clockwise closes the gap; counter-clockwise opens the gap.



The four Circles in the above Illustration indicate the Spark Gap Adjustment Knobs. A Hinged Cover is shown in raised position.

As the quality and performance of the cutting current is dependent on accurate gap adjustment, it is essential that this operation be properly performed. There is nothing difficult about this gap adjustment—on the contrary, it is a very simple procedure that requires only a few seconds—but it must be done right to insure satisfactory operation of the cutting current.

To adjust cutting gaps, first press left hand treadle on the foot switch to start current flow through the gaps. With the left hand pedal depressed, look at gaps through the observation window. If any of the gaps are not firing, turn its adjustment knob (or knobs) counter-clockwise to open the gap slightly until firing starts. It is essential that all gaps be firing prior to adjustment. IF UNABLE TO MAKE ALL GAPS FIRE, SEE FOLLOWING SECTION, page 5.

1—After all gaps are firing, take each individual gap (for example, start at left and work to right), carefully align your eye with the gap being adjusted and—

2—Turn its adjustment knob CLOCKWISE until it *stops* firing. Then—

3—Slowly turn knob COUNTER-CLOCKWISE until you see the gap start to spark THEN STOP!—and note position of small white dot on knob.

4—From the point where continuous sparking was first observed, TURN KNOB COUNTER-CLOCKWISE ONE FULL TURN, which will put that particular gap in proper adjustment.

ADJUST ALL GAPS IN THIS MANNER.

It is important that the observer's eye be lined up directly with sparking surface on gap being adjusted. The best way is to close one eye, and move the head laterally in front of the gap to the point where firing seems most intense. The arc that takes place is quite small and, if viewed from even a moderate angle, you may not see the first sparking in the gap.

from which point the subsequent one turn counter-clockwise adjustment must be made.

For safety, the gap adjustments should be made each time before an operation is started. While the gaps will, under ordinary conditions, retain their adjustment over quite a period of time, if the machine is moved around or jolted they may get slightly out of adjustment and for safety and assurance of satisfactory performance we recommend a complete gap adjustment *each* time before starting to work.

When correctly adjusted, intensity of the arc in each gap should appear about the same to the eye. If a particular gap appears to fire with less intensity than the others, it probably means that it *has not been opened enough* and should be completely readjusted in accordance with above instructions.

If any one gap fires irregularly or sputters, it very likely means that the gap needs readjustment because it *has been opened too wide*. If one or more of the gaps are opened too wide, or if they are adjusted improperly so that one takes most of the load, there will be a decided sputtering in that one gap (or all gaps, if all are opened too much). The sputter can be seen and its crackling sound distinctly heard. A single sputter at rare intervals is of no consequence, but if heard often or continuously, all gaps should be correctly adjusted.

We have elaborated on this spark gap adjustment, not because it is difficult or complicated, but rather on account of its relative importance. Correct gap adjustment is essential to satisfactory operation of the cutting currents. If the machine seems to lack cutting power—if it cuts slowly—these are sure signs that the gaps are not in adjustment and they should be properly set before further use.

Remember these simple instructions:

HAVE ALL GAPS FIRING BEFORE THE ADJUSTMENT IS STARTED.

HAVE THE EYE LINED UP DIRECTLY WITH SPARKING SURFACE and catch the point where firing first begins. This is a critical factor in the adjustment. You must see the very first continuous sparkle and open the gap one full turn, counter-clockwise, *from the point where firing was first observed.*

ADJUST ALL GAPS EACH DAY BEFORE WORK IS STARTED.

These Bovie gaps incorporate a unique, patented, self-compensating feature which insures their continuous, satisfactory operation and consistent performance. *When properly adjusted,* the machine is brought to a condition of stability and, under equivalent conditions, results can always be duplicated—you know in advance the results to be expected from a given power setting.

If Unable to Make Gaps Fire

1. Occasionally some uninformed persons may needlessly turn the knobs and close one or more gaps several turns or open them up a number of turns. If this occurs, it may appear impossible to get the gaps to fire. Fortunately there is a simple remedy for this seemingly perplexing condition.

The thing to do is first, *close all gaps completely* by turning each adjustment knob clockwise until resistance is felt and further motion arrested. This may require anywhere from two or three to thirty or more turns, depending on whether gap is partially open or closed at the start. Stops limit the number of possible turns in either direction and considerable resistance is felt when this limit is reached. Don't attempt to turn knob BEYOND POINT WHERE RESISTANCE IS FELT. To do so might damage gap mechanism.

After all gaps are completely closed—after all knobs have been turned clockwise until resistance is felt—then step on left pedal and *open one gap* until it starts firing. This will require from fifteen to twenty-five *counter-clockwise* turns. Then open the other gaps in same manner until all are firing. After all gaps have started to fire they should be correctly adjusted in accordance with instructions in preceding section.

2. Make sure that machine is connected to correct current supply.

3. Make sure that the supply line is not "dead" because of burned out fuses or other reasons.

4. See that the foot switch is connected.

Pilot light will glow when machine is connected to proper current supply and main switch turned "on", but no high frequency current is generated unless one of the foot switch treadles is pressed.

With the supply cable and foot switch connected and gaps properly adjusted, the machine is ready for service and you can

CONNECT INDIFFERENT ELECTRODE to the terminal marked "Patient", using a cord with clip on one end and round plug on other. The clip is fastened onto the metal indifferent plate. (See accompanying booklet, "Fundamentals of Electro-Surgery" for further information on applying indifferent electrode).

When Used For Aseptic Surgery the various parts that require touching or handling during operation should be sterilized before they are connected. These include the sterilizable instrument rack, the electrode holders with their cords, and the required operating electrodes. (See subsequent section on methods of sterilization.)

With these parts sterilized you are ready to:

Insert Sterilizable Handles in openings in the controls. Turn handle two or three clockwise turns to lock it in place.

Insert Operating Electrodes in handles by unscrewing to release chuck, inserting electrode and then tightening chuck carefully.

Install Sterilizable Instrument Rack. If instrument rack is too high for convenience with both straight sections in place merely leave off one length, or both.

Connect Operating Electrode Handles to any of the three terminals marked "Electrode." All deliver the same current. One, two or three handles may be connected as required. Lay handles with their instruments in place on the sterilizable instrument rack.

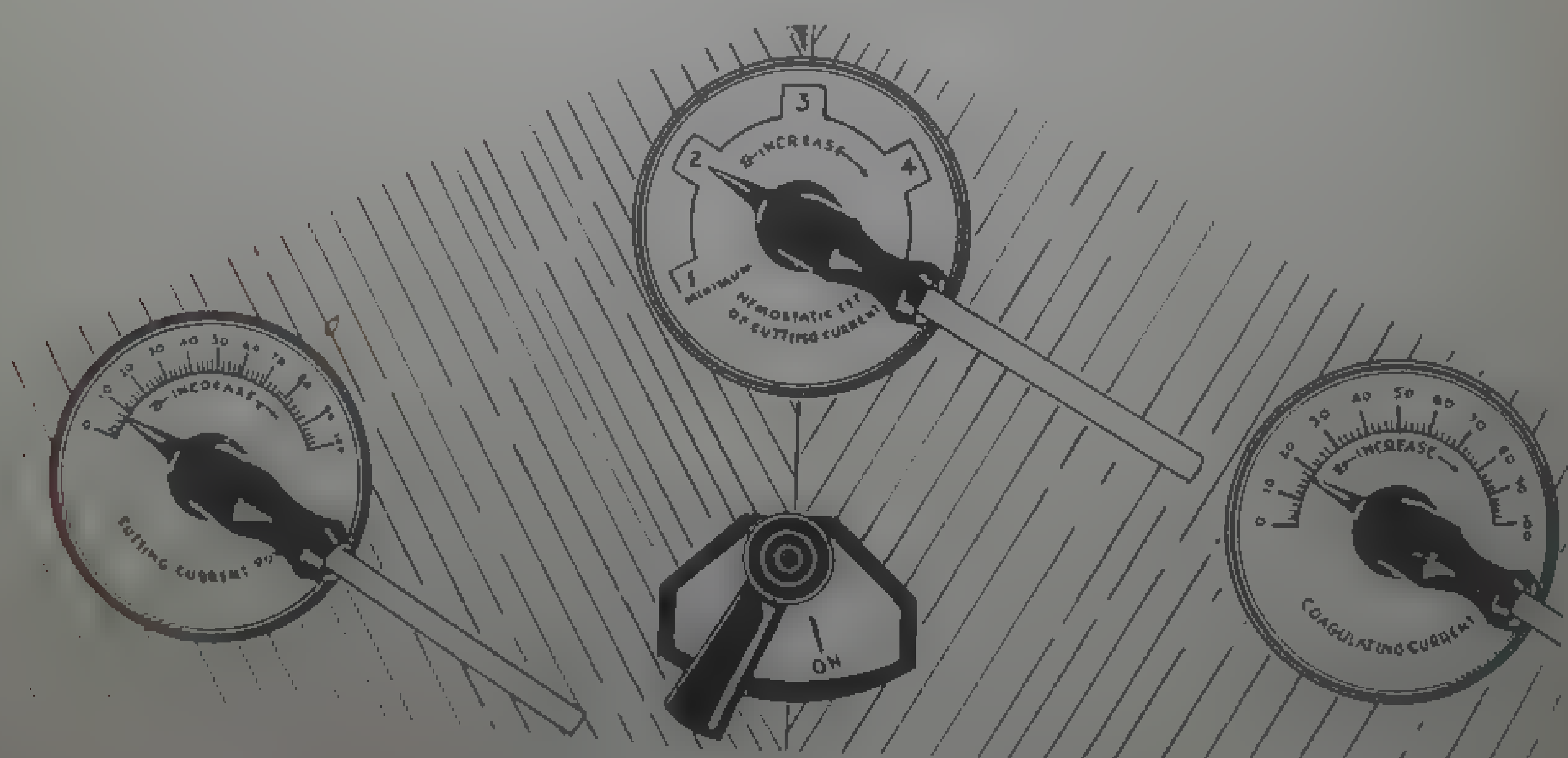
Setting the Controls

With the foregoing adjustments and connections made, the machine is ready for service except for setting the controls. These should be adjusted to best values for the work at hand.

Full control of the currents is afforded by the three rotating handles on the top panel, marked as illustrated at bottom of this page.

Rotating through their graduated scales, the two power controls afford a constant, unbroken range of power from zero up to maximum output of the circuit. These scales are purely arbitrary, indicating the relative current strength between minimum and maximum settings. The ratio of current strength to dial settings is not uniform throughout the scale.

The amount of power required—either cutting or coagulation—involves a number of variables so that experience and familiarity with the machine and different electrodes used under various conditions are really required to determine the best setting. However, if the fundamentals are understood, the operator will, with a little experience, have no difficulty in making correct settings for different types of work.



First, let us consider the variable factors that influence the power required for *electro-cutting*.

Cutting Power Required in General Surgery will vary, depending on—

A—*Nature of tissue being sectioned.* Fat or cartilage requires more power than skin or muscle. Sclerotic, fibrotic or cicatrical tissue will require more power than softer structures.

B—*Depth of Incision.* A deep incision (with the same electrode and a given speed of cut) requires more power than a shallow one.

C—*Rate of speed at which cutting electrode is moved;* fast cuts require more power than slow.

D—*Type of electrode used.* For a given depth of incision with equivalent speed of cutting, the amount of power required will depend on the thickness of the electrode used. The thinner the electrode, the less power required.

With these fundamentals in mind, it can be seen that power settings are *not* fixed arbitrary figures, subject to no variation. Rather, the surgeon should learn that this is a flexible factor and that best results are secured by varying the power settings to meet the immediate conditions.

There is one safe general rule that applies to all conditions, namely:

Use the lowest possible Power Setting which, with the Electrode in use, cuts freely to the desired depth.

This rule, if followed, will result in a minimum of sparking and flashing at the electrode—will prolong the life of operating instruments—will prevent charring or excessive coagulation of the wound edges.

As noted above, variables prohibit recommending definite power settings for different conditions. These can be learned only by studying performance of the [illegible] actual operations, under your own conditions. However, it is feasible to give power ranges within which certain results can be secured and the following will serve as a guide in starting out. These figures [illegible] to the "Cutting Power Control" at the left.

Using the small flat blade, a power setting of 30 to 35 will permit fairly rapid incisions through skin or muscle, ⅛" to ¼" deep.

Settings between 35 and 45 will make rapid incisions up to about ½" deep.

From 45 upward will cut the full depth of the small blade.

The above settings apply to the use of the small flat blade. The large flat blade, the small needle, and the large needle, in the order named, require slightly more power. To cut the full depth of the large blade around 55 will be required. About 60 will cut the full depth of the large *needle*.

With the smaller loop electrodes, around 40 to 45 will "scallop" small bits of tissue. From 45 to 50 will excise fairly large pieces of tissue and for big segments with the larger loops, from 55 upwards will be required.

Please recall that the above are not fixed arbitrary figures. They may vary if your line voltage is above or below normal. In a wet, bloody field, considerably more power may be required than in drier tissue. To cut under water, special electrodes are needed and considerable power must be used. Recall that fatty tissue or cartilage require more power than skin or muscle. As actual work is done, experiment with different amounts of power and note the settings that give best results under various conditions. Experiments on meat, as outlined in our booklet "The Fundamentals of Electro-Surgery," are very valuable and are highly recommended before work is started on an actual patient.

NOTE—Electro-cutting should always be done by the bipolar method; that is, a large indifferent electrode should be applied to the patient's bare skin. Under certain conditions it is physically possible for the surgeon to cut without an indifferent electrode, but this is not recommended for general use. For a given depth of incision it requires a great deal more power to cut without an indifferent electrode (monopolar) than it does with the bipolar method. Also, if an indifferent electrode is not used a direct current path is not provided through the patient and there might be a tendency for the current to "leak" out

through the operator. For these reasons we recommend that cutting always be done by the bipolar method. The approximate power settings shown above are based on an indifferent electrode being used.

Hemostatic Effect of Cutting Current

Electro-Cutting is accomplished by a small, intense arc which forms just ahead of the electrode. The intense heat of this arc volatilizes a small zone of tissue cells which pass off as vapor and, as the electrode moves along, the tissues part as though severed by the sharpest scalpel. As the electrode passes through, the heat of the arc creates on the edges of the wound a shallow zone of dehydrated or coagulated tissue and this dehydration seals off the capillaries and smaller blood vessels and prevents bleeding and oozing from these sources. The degree of hemostatic effect secured with electro-cutting depends directly on *the depth of dehydration on the edges of the wound.* The deeper this dehydration, the more hemostatic effect. The less dehydration, the more bleeding.

While the depth of dehydration caused by the cutting current depends, to a certain extent, on the electrode used, the amount of power and speed of cutting, it is governed chiefly by the "Wave Form" or "Characteristic" of the current.

A most important feature of this new Davis-Bovie Unit is the center control marked "Hemostatic Effect of Cutting Current" which, by changing the current characteristics, varies the depth of dehydration caused by the cutting current on the edges of the wound, other conditions remaining unchanged. This feature makes it possible to secure, at the operating electrode, a current of hemostatic qualities best suited to the particular work being done.

With this control at the No. 1 position, only a pure cutting current with little dehydrating (hemostatic) effect reaches the electrode. Rotating this control through its scale from No. 1 (minimum) to No. 5 (maximum), alters the current characteristics so as to increase the amount of coagulation on the wound edges, which in turn reduces hemorrhage.

The possibilities of these currents have not been fully explored, but the work to date shows clearly that this feature affords a degree of flexibility never before achieved in any electro-surgical unit. The ability to select a cutting current with hemostatic effect that best suits the immediate condition is an obvious advantage.

For example, in making skin incisions, the "Hemostatic Effect" control should be set at No. 1 so as to produce an absolute minimum of dehydration on the skin margin, insuring strong healing per primum.

On the other hand, in cutting through extremely vascular areas where primary union is not expected, the "Hemostatic Effect" control can be advanced, a current with more dehydration effect fed to the electrode, and tissue severed with infinitely less bleeding. As an example, in working on extremely vacular areas such as the lip, tongue, cervix, etc., where primary union is not involved, the heaviest "Hemostatic Effect" can be used with a substantial reduction in hemorrhage. Under certain conditions truly bloodless cutting is possible. For example, using the Davis-Bovie Unit on heaviest "Hemostatic Effect" and with a large needle electrode, we have seen experimental incisions made bloodlessly in a dog's liver. This is cited simply to illustrate the extreme degree of hemostasis which can be secured from the cutting current by properly adjusting this control and selecting the correct electrode.

A careful study of the "Electro-Cutting" section of our booklet "Fundamentals of Electro-Surgery" will convey a good idea of the basic principles underlying the use of these currents.

One point requires special emphasis—namely—in making skin incisions where primary union is expected, set the "Hemostatic Effect of Cutting Current" control at No. 1—use only the smallest blade electrode—avoid the use of too much power—and make the cut rapidly. This will result in minimum coagulation of the skin margins and there will be little, if any, interference with primary union. *If any considerable amount of coagulation remains on the skin margins, healing per primum will be very slow and may not occur at all.*

Cutting Under Water

Under-water cutting requires electrodes with insulated shanks so that all current will be concentrated on the cutting area of the electrode. The uninsulated open-air electrodes will not cut under

water because a larger proportion of the cutting current will be dissipated into the water from the bare shank of the electrode.

Therefore, do not expect to cut under water except with electrodes designed especially for that purpose.

For under-water cutting *(prostatic resection)* only the first three steps of "Hemostatic Effect" can be used. As this control is advanced towards maximum, the current characteristics are altered so much that under-water cutting is decidedly interfered with. Towards the heavier "Hemostatic" settings it will cut poorly, if at all. Therefore, in Prostatic Resection, use only the first three steps on this control. For average conditions the No. 1 setting of this control is best but in an extremely Vascular Gland advancing the control to step 2 or 3 will tend to reduce Hemorrhage, with a slight reduction in cutting quality.

Power Settings for Electro-Coagulation and Desiccation

For this work current is applied by various methods through electrodes of different sizes and shapes so that an understanding of the different conditions is necessary before power settings can be worked out.

Electro-Coagulation can be defined as a process in which a high frequency current is employed to actually "cook" tissue surrounding the active electrodes. Enough heat to do this is generated within the tissues by the current passing from the electrode into the surrounding tissue.

Electro-Desiccation is a procedure similar to electro-coagulation except that the active electrode is not placed in actual contact with tissue. Current is allowed to jump through space and, sparking onto the surface being treated, dehydrates the superficial layers of tissue. This sparking action is sometimes called "Fulguration."

These two methods of application produce exactly the same effect on tissue—namely—the cells so treated are dehydrated, or coagulated, or, actually cooked—the difference being that contact coagulation penetrates more deeply, causes a greater depth of destruction—whereas desiccation affects only the superficial layers.

Both coagulation and desiccation can be done with or without an indifferent electrode. To denote these two conditions the following terms are used:

1—*Monopolar* when a single active electrode is used without an indifferent electrode.

2—*Bipolar* when an indifferent electrode is used for current return path, or when the new type bipolar applicators, consisting of two needles in a common handle are employed.

These terms are used merely to indicate the method of applying current. There is no difference in the surgical effect of the current or in their electrical characteristics. The only difference is in the amount of power secured from a given setting. *For a given power setting* more current is obtained with bipolar applications than with monopolar.

The amount of power required for this work varies widely and depends on:

A. Size of Electrode used.
B. Area of Electrode in contact with tissue.
C. Depth and area of destruction desired.
D. Length of time current is applied.

Again, it is not possible to give definite power settings for various classes of work, but the following will serve as a starting point. These figures apply to the "Coagulation Power Control" at the right.

MONOPOLAR DESICCATION

Very light—15 to 20
Light —20 to 30
Medium —30 to 40
Heavy —40 upward

BIPOLAR COAGULATION

Very light—10 to 15
Light —15 to 20
Medium —20 to 30
Heavy — 30 upward

BLADDER FULGURATION

From 40 to 60, depending on size of tip and amount of destruction desired.

Settings shown above will apply when the current is used for tissue destruction.

For electro-hemostasis by the clamp and coagulation method, power requirements will vary considerably, depending on the size of the clamp used, the amount of tissue picked up, the size of the bleeder and other factors. In general, however, a power setting of around 25 (bipolar method) will prove adequate if only small amounts of tissue are picked up in the clamp and from 30 to 35 if larger clamps are used and larger bits of tissue picked up. See "Fundamentals of Electro-Surgery" for more details.

Instructions for Using The Braasch-Bumpus Resector With The Improved Davis-Bovie Unit

With the Braasch-Bumpus Resector, the segment of tissue engaged in the fenestrum of the sheath is rendered ischemic by coagulation with a multi-needle electrode before excision with the tubular knife. Following excision of the segment, bleeding from individual vessels is controlled by coagulation with a single pointed fulgurating electrode of the Bugbee or similar type.

For preliminary coagulation with the multi-needle electrode, the *cutting* current is used. This is perfectly safe and satisfactory as when applied through these large needles the current loses its cutting characteristics and will coagulate only. For sealing individual bleeders with the fulgurating electrode, the *coagulation* current is used. Settings of various controls on the machine are as follows:

Hemostatic Effect of Cutting Current—Step No. 1
Cutting Current Power—60
Coagulation Current Power—45

The multi-needle electrode is connected to any one of the three terminals marked "Electrode"; the single pointed fulgurating electrode is connected to another of these terminals. Both electrodes are thus ready for instant service without changing any wires or connections. It should be remembered that *both* electrodes are activated whenever either foot treadle is pressed, therefore the electrode *not in use* should be laid at some place on the instrument stand where the operator or an assistant cannot accidentally contact its tip and get a high frequency burn. Also the electrode *not in use* should be placed on a dry towel or some other insulating material to prevent accidental short-circuiting of the entire output of the machine. This would not damage the machine but would very likely ruin the tip of the electrode.

With the tissue to be removed engaged in the fenestrum, the multi-needle electrode is thrust into the base and the *cutting* current turned on by pressing the *left* treadle on foot switch. Three to six seconds application of the current will be needed, depending on vascularity of the tissue, to render it ischemic. This being completed, the electrode is withdrawn and the segment of tissue excised with the tubular knife.

If uncontrolled bleeding from individual vessels is observed, it may be stopped by applying the *coagulation* current through the single pointed fulgurating electrode. To turn on coagulation current, press *right* treadle on foot switch.

FOR FULL DETAILS OF THE OPERATIVE PROCEDURE SEE THE BOOK "MINOR SURGERY OF THE URINARY TRACT," BY BUMPUS, CRENSHAW AND CLARK. PUBLISHED BY W. B. SAUNDERS COMPANY, PHILADELPHIA

Instructions for Using The Improved Davis-Bovie Unit in Treating Detachments of the Retina

In treating retinal detachments with high frequency currents, the object of the operation is to create through the sclera and choroid small punctures which will permit escape of the sub-retinal fluid with collapse of the detachment, and at the same time to create on the choroid minute spots of inflammatory adhesive choroiditis to which, in favorable cases, the retina will adhere.

Special single and multi-pointed needle electrodes (see accompanying bulletin), activated by the Davis-Bovie cutting current are used to accomplish these results. DO ALL DETACHED RETINA WORK WITH THE CUTTING CURRENT AND THE "HEMOSTATIC EFFECT" CONTROL SET ON NUMBER 4.

To prepare the machine for detached retina operation, adjust the cutting section spark gaps in the regular manner as previously outlined. Apply indifferent electrode under patient's shoulder and connect it to the "Patient" terminal. Connect operating handle (or handles) to any of the "Electrode" terminals.

Set "Hemostatic Effect of Cutting Current" control on number 4, which is always used for Retinal Detachments.

Set "Coagulation Current Power" at O. This is an important safety measure to prevent applying the coagulation current if the wrong foot switch treadle should be pressed.

The Left Treadle is Used for Turning Current On and Off

Set "Cutting Current Power" control on proper setting, depending on the number of points on the electrode being used.

In treating retinal detachments, bear in mind that the number of points on the electrode governs the power required. Correct current strength for varying numbers of points has been carefully worked out through extensive animal experiments and clinical work. The power requirements vary within narrow limits depending primarily on whether the surface of the sclera is absolutely dry and free from small tags of tissue, and to a very limited extent on the voltage of the line from which the machine is operated.

Under normal line voltage conditions and where it is possible to maintain an absolutely clean, dry field, the following "Cutting Current Power" settings should be used:

One-point electrode	20
Two-point electrode	22
Three-point electrode	24
Four-point electrode	26
Six-point electrode . . .	30

If an absolutely dry field can not be maintained —even with small amounts of moisture on the sclera —the above figures will need to be increased slightly, by about two or three scale divisions.

Also, if it is known that an extremely high or low line voltage exists, these settings may need to be altered a scale division or two to compensate for this. However, in most locations and under average operating conditions, the above settings will prove satisfactory.

BE SURE TO SET "CUTTING CURRENT POWER" ON PROPER DIAL SETTING FOR THE NUMBER OF POINTS ON ELECTRODE BEING USED. IF ELECTRODE IS CHANGED BE SURE TO CHANGE POWER SETTING

The Operating Instruments

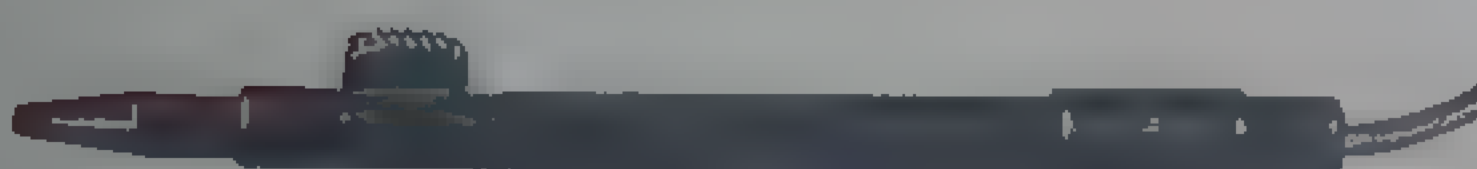
The various electrodes used, together with handles, are illustrated below.

The forcep type holder is used in applying the small electrodes. It is arranged so that when the button is pressed about half way down, it will grasp and hold the electrode. When further depressed, it will establish contact with the current and so activate the point.

The chuck type handle for applying the extended shank electrodes, is equipped with a current cut-off button. Electrodes are fastened in this handle by unscrewing the tip two or three turns, putting the electrode in place and then tightening tip.

Application of various electrodes is more fully described in the following section.

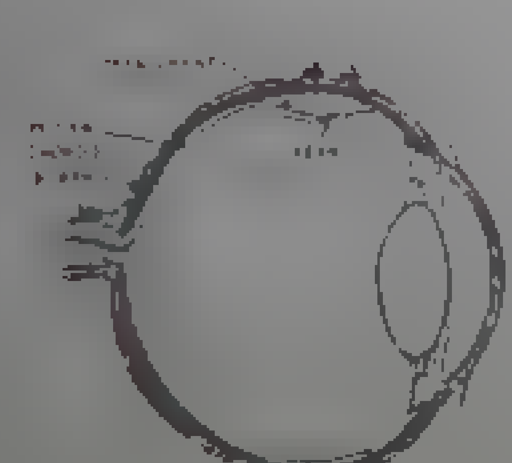
Forcep type holder with current cut-off for applying small electrodes.



Chuck type handle with current cut-off for applying extended shank electrodes.

Above, a group of multi-point needles on small, insulated bars with eyelets for sutures. Below: two extended shank electrodes, one and six points. Shanks are made of insulated, pliable material that may be bent with the fingers to facilitate approach to field. Illustrated about two times actual size.

Technique Suggestions in Treating Retinal Detachments

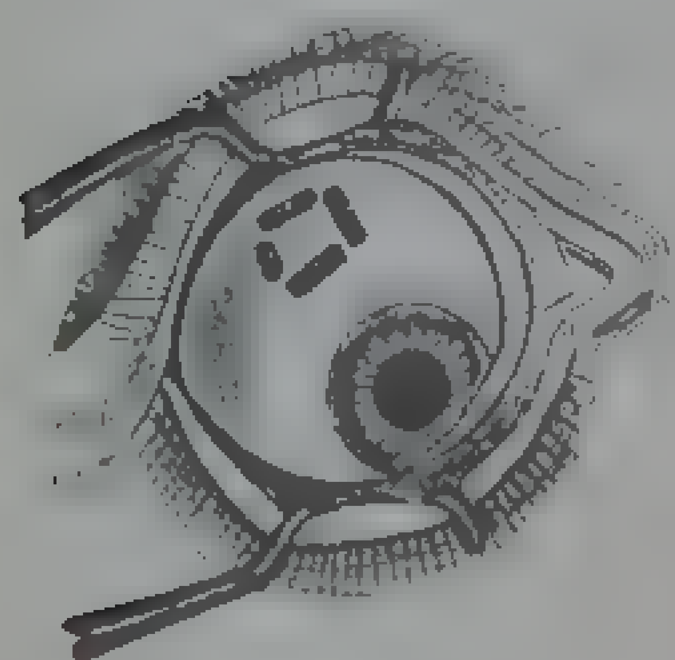


The needles are placed to encircle and seclude the TEAR

The object of this operation is to create through the sclera and choroid minute punctures so placed that the *tear* will be encircled when the fluid escapes and the detachment collapses onto the choroid.

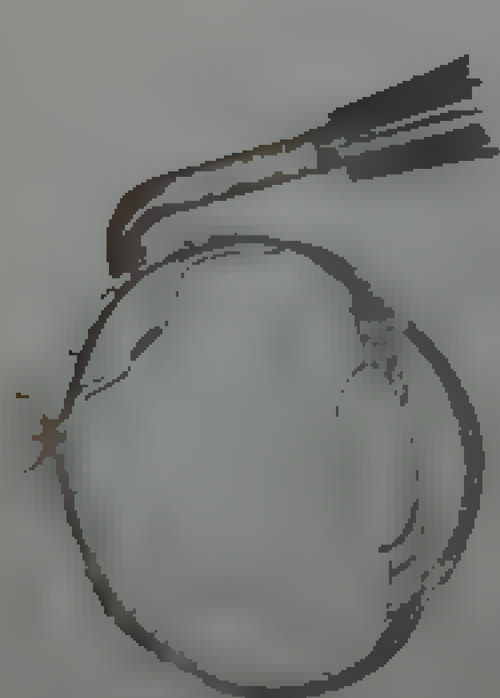
When the detachment lies well forward, near the ora serrata, it is best treated with the small multi-point electrodes (Safar's so-called "nails") which are applied with the forcep type holder and left in situ until treatment is completed.

Application of small electrodes with forcep-type holder. Two are shown in place, the third being applied.



Four small multi-point electrodes in situ.

Appearance of sclera after electrodes are removed.



Detachments far back are reached with extended shank electrodes.

A most important point in the application of this current is to have the surface of the sclera clean, dry and free from small tags of tissue before the electrode is applied.

In applying the small electrodes, first pick them up with the forcep and lightly contact the points with the sclera, having a light, even pressure on each point. At this stage it is important to avoid too much pressure on the electrode—only a light contact is necessary.

With the points lightly touching the sclera, first step on left treadle of foot switch to turn on machine and then further depress the button to contact current with the points.

If the needles have been properly applied, they will instantly sink into the sclera when the current is turned on, and when they have been plunged into their full depth—when the insulated base of the electrode touches the sclera—the current should be turned off *immediately*, the electrode released and left in situ.

This is a very quick acting current and only a fraction of a second is required for the electrodes to sink in and create the puncture. IT IS MOST IMPORTANT THAT CURRENT BE TURNED OFF INSTANTLY AFTER THE POINTS SINK INTO THEIR FULL DEPTH.

In working near the margin of the eyelid, be sure that forceps or base of electrode does not come in contact with the lid or other tissue. If this occurs, current will go to this point rather than to the needle and the point will not sink in and create a puncture.

These small "nail" electrodes can be used successfully only in the case of anterior detachments and even in treating some of these, if working close to or under the lid margin, it may be necessary to apply the single point extended shank electrode to the posterior zone in order to avoid establishing contact with the lid or other tissue.

Detachments lying far back must be attached with the extended shank electrodes used in the chuck type handle. In the case of small detachments, the single point should be used, placing a row of punctures so as to encircle the tear as nearly as possible.

These electrodes can not, of course, be left in situ; there will be some escape of sub-retinal fluid, and extra care is required to keep the sclera dry in the region being punctured.

Large posterior detachments can best be attacked with the six-point electrode by repeated applications, placing enough punctures to cover the desired area.

As in the case of the small points, it is necessary to first lightly contact the sclera with the needles, turn on current and then shut it off instantly when the points are plunged into their full depth. It is important that all points be lightly and evenly in contact with the sclera before current is turned on.

The shanks of the long electrodes are made of a pliable metal that can be bent with the fingers to facilitate approach to the operative field in detachments lying far back.

STERILIZATION OF ELECTRODES AND ACCESSORIES

In preparing the Davis-Bovie Unit for aseptic surgery, all parts that are handled or touched in the course of an operation should be sterilized prior to use. These include the sterilizable instrument rack and its supporting standard; the operating electrode handles with their cords and plugs; sterilizable glass handles which fit into the three controls; all needles, knives, loops, blades and other operating instruments.

The metal parts, including the entire instrument rack assembly, the uninsulated loops, needles, knives, etc., can be sterilized by prolonged boiling or auto-claving without damage.

However, the bakelite handles, rubber cords and insulation on electrodes will be subject to some deterioration when heat sterilization is used, and they will require replacement from time to time.

The useful life of the insulating parts can be lengthened by sterilization in some adequate cold solution, *i.e.*, 70% alcohol, mercuric cyanide (1 to 1000), etc. However, we do not recommend cold sterilization in Neuro-surgery, operations in the Thoracic Cavity, in the abdomen, etc., where immaculate conditions are essential.

For these operations where heat sterilization must be employed, the best method is to wrap all instruments and handles in a towel and sterilize them in the auto-clave for fifteen minutes at 15 pounds pressure. This is considered adequate for most major surgery and does not cause undue deterioration of the bakelite and rubber parts. Wrapping these parts in a towel, however, is important as this minimizes deterioration.

For Prostatic Resection instruments the customary mercuric cyanide solution is recommended. Phenol solutions should not be used on any bakelite insulated instruments.

SERVICE NOTES

The only thing on the Bovie Unit that will ever need special attention is the spark gaps which will require reconditioning after a large number of major operations. This would ordinarily be after three to five years' service in an average institution. This is handled on a replacement basis from the factory. The need for gap reconditioning is indicated by a gradual impairment of cutting quality and/or irregular, sputtery gap operation. When this occurs, communicate directly with the Company for detailed instructions.

Other than infrequent gap reconditioning as above noted, the only service or maintenance required will be repairs or replacements of electrodes, handles, and other accessories. Electrodes, handles, and their cords, the supply cable and foot switch cable may need repairs if the wires become frayed or broken. If any of the accessories or cables need repairs, communicate with our nearest representative or direct with the Company.

This booklet covers primarily the mechanics of adjusting and preparing the Davis-Bovie Unit for service. The accompanying booklet "The Fundamentals of Electro-Surgery" contains a great deal of information that will be valuable to those just undertaking Electro-Surgery. Its careful perusal and a thorough study of the reprints on Electro-Surgery is recommended before actual operative work is undertaken.

CERVICAL CONIZATION TECHNIQUE

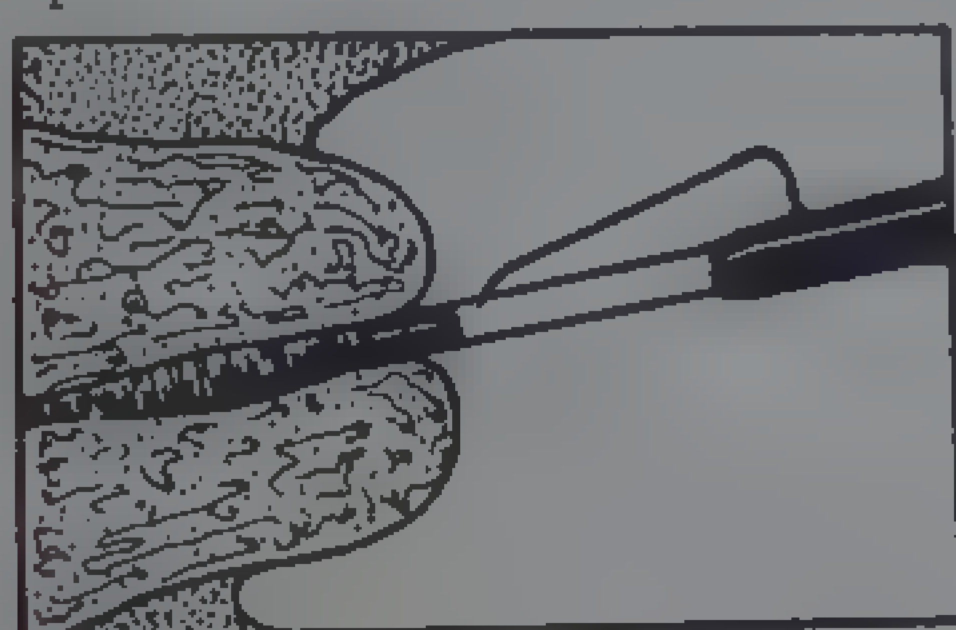
With the vaginal speculum inserted to expose the cervix, the vagina and cervix are freed of all discharge by swabbing. It is important that the cervix be perfectly dry.

The indifferent electrode is placed under the patient's buttocks or over the abdomen(held in place by sandbag or pressure of patient's hands) and connected to the Bovie Unit.

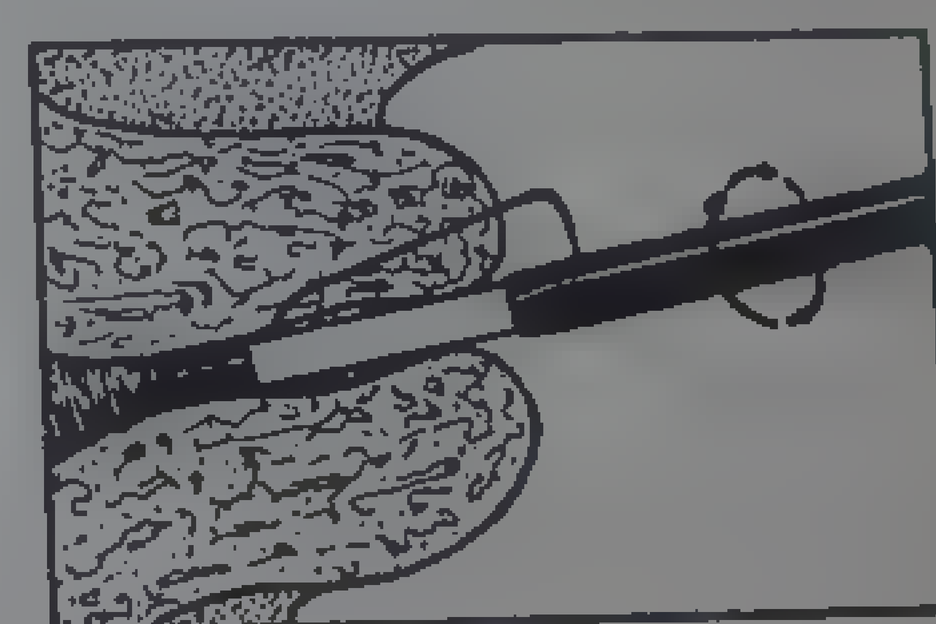
The cervical canal is measured and the depth necessary to insert the instrument is noted. The tip of the instrument should reach the internal os to assure excision of ALL the cervical mucosa.

The proper coning electrode is inserted in handle, which is connected to the active terminal of the Bovie Unit. The cutting current is set to deliver the proper amount of power.

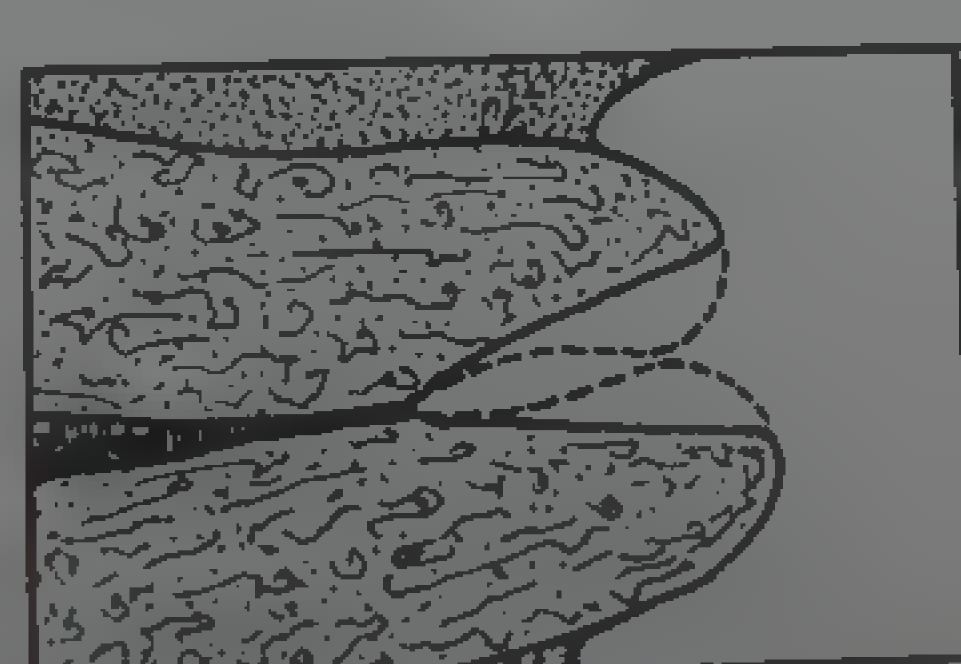
Actual conization is then carried out in the following steps:



1 - Tip of instrument is placed into the external os with loop just contacting the tissue. Cutting current is turned on with the foot switch and instrument advanced into the canal to the required depth, the loop cutting its way in. The insulated tip guards against cutting the internal os.



2 - With the current on, the instrument is rotated through one full turn (not necessarily in a single motion) which results in the excision of a cone shaped segment of cervical tissue. The extended insulated tip serves as a fulcrum for the even turning of the electrode.



3 - Foot switch is released and the instrument withdrawn, bringing with it the excised piece of tissue.

(See Reverse Side

The cone shaped segment of cervical tissue will be found adhering to the loop. This excised tissue should include the full columnar epithelial lining of the canal. Cervix then presents the "Coned Out" appearance as illustrated.

If more tissue must be removed the instrument may be re-inserted and previous steps repeated until the desired amount has been coned out. If tissue must be removed from the depths of the endo-cervical canal, the smaller No.2100 electrode is inserted in handle and the canal reamed out to the desired depth.

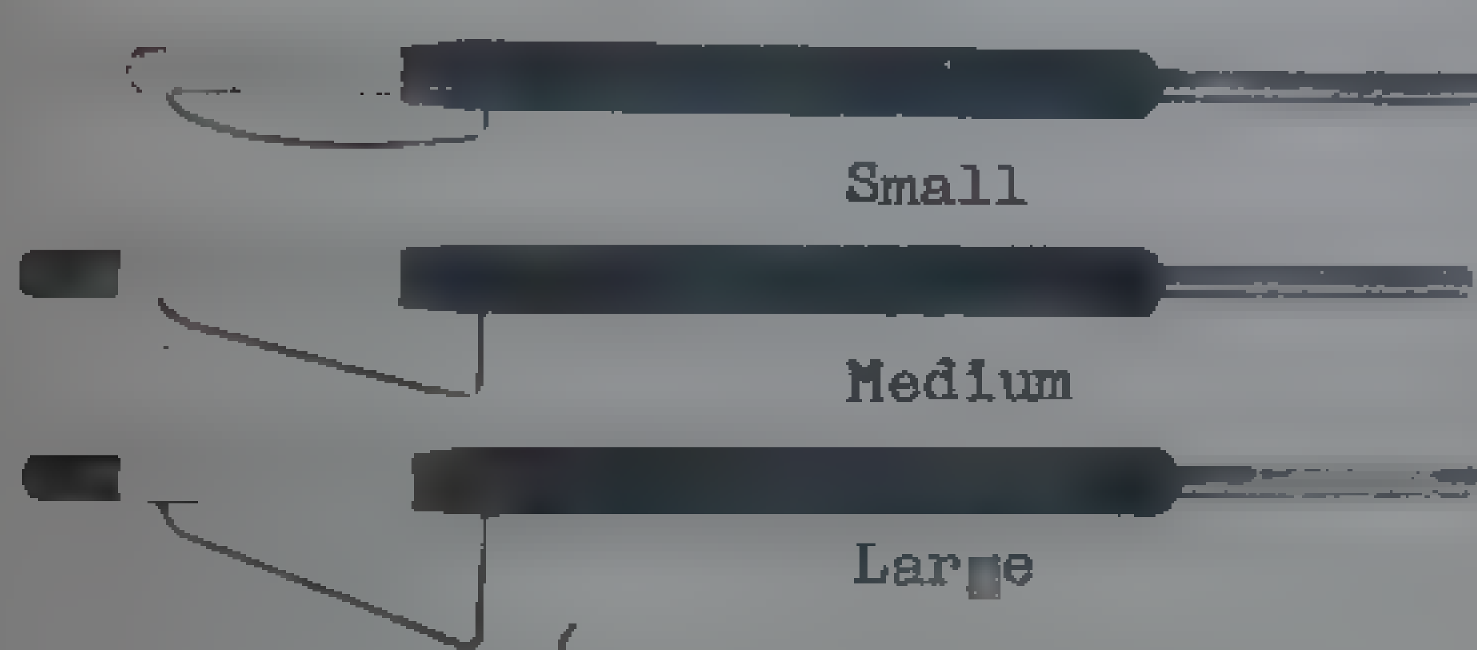
Under ordinary circumstances the cutting current will prevent hemorrhage but if bleeding does occur, the needle may be inserted in the electrode handle and the coagulation current sparked onto the bleeding point.

* * * * * * * * * * * * * * * * *

L - F

CERVICAL CONIZATION ELECTRODES

L-F Cervical Conization electrodes are substantially made and insulated with Isolantite. The loop is of heavy tungsten wire. They are long lived -- do not break or burn out readily. The extended tip acts as a swivel which permits accurate rotation of the loop and the removal of just the right amount of tissue.



No.2100 - For reaming the endo-cervical canal.

No.2101 - For removing a small cone of cervical tissue.

No.2102 - For removing a fairly large cone at the cervix.

NOTE: Illustrations of electrodes are actual size.

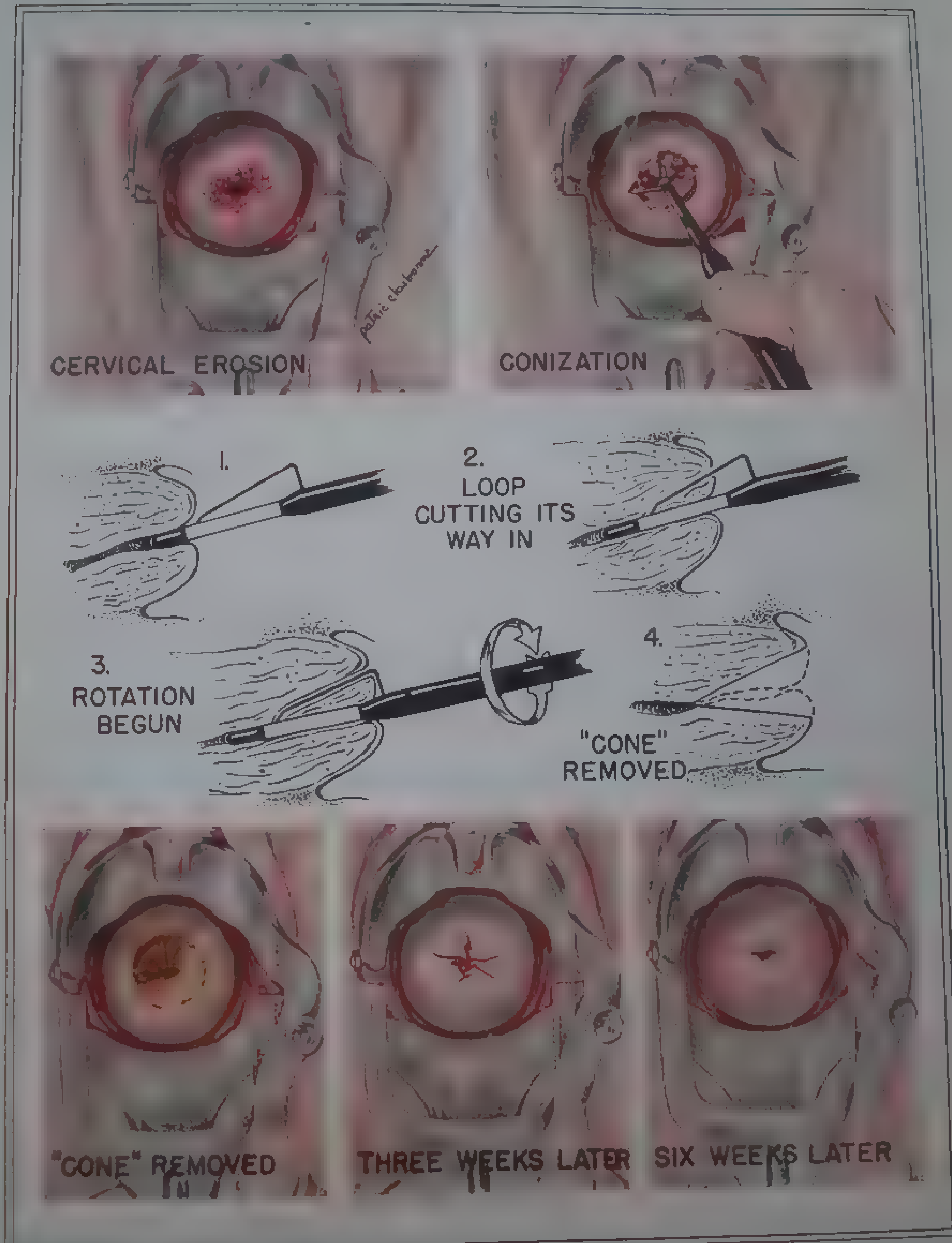
PRICE - \$3.50 each

Set of 3, ordered at one time - \$10.00

THE LIEBEL-FLARSHEIM CO.
303 WEST THIRD ST., CINCINNATI, OHIO

Printed in U.S.A.

CONIZATION OF THE CERVIX UTERI



Drawn by Patric Claiborne. Courtesy Medical Art Section, Medical Center of Washington, D. C.

FUNDAMENTALS of ELECTRO-SURGERY

WITH THE

BOVIE UNIT

1940—REVISED EDITION

THE LIEBEL-FLARSHEIM CO.
303 WEST THIRD ST., CINCINNATI, OHIO

FOREWORD

This booklet outlines the basic principles and describes the effects of the currents used in electro-surgery. We have not attempted to include elaborate operating technique. Rather, the fundamentals are covered, leaving it to the surgeon to interpret these principles in terms of actual operative work.

As a foundation for electro-surgical operations the information herein, plus a thorough study of current literature, will prove helpful.

We will gladly cooperate in the solution of any electro-surgical problems that may arise in your work.

S. C. Holston, Vice-President
THE LIEBEL-FLARSHEIM COMPANY

THE FUNDAMENTALS OF ELECTRO-SURGERY

INDEX

FUNDAMENTALS OF ELECTRO-SURGERY

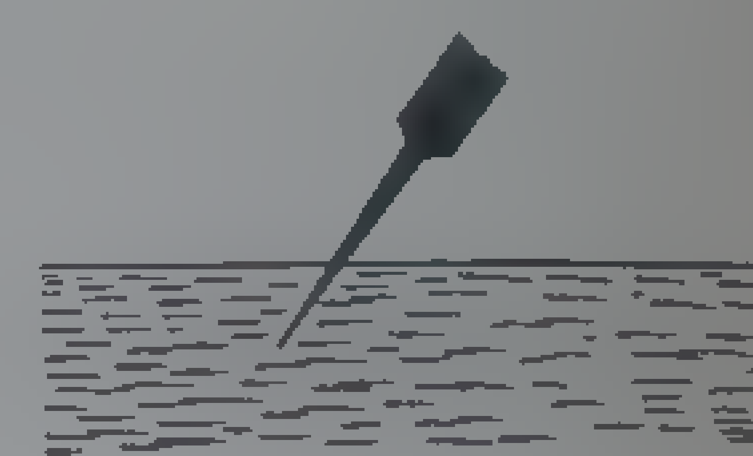
— TERMINOLOGY —

Our modern concept of electro-surgery embraces the use of two distinct types of high frequency current - cutting and coagulation. Applied in various ways, these produce on tissue varying effects of surgical value.

While electro-surgery has produced many descriptive terms, for the purpose of this work we will limit our terminology to the three most generally accepted words describing these surgical effects. These are;

1 - ELECTRO-CUTTING, which is self-explanatory,

2 - ELECTRO-COAGULATION, (or coagulation), to denote the action of current when an active electrode is contacted with the tissue, and,



Electro-Coagulation — Inserting a needle electrode into the tissues

3 - ELECTRO-DESICCATION, (or simply desiccation), to indicate the superficial drying-out that takes place when a shower of sparks is allowed to play onto tissue from the end of an electrode without actual contact.

Electro-Desiccation — Sparking the tissue without actual contact

While these effects are quite different, they are distinctly inter-related, in fact, the remarkable success of electro-surgery in many operations is due to the joint use of the two currents, e.g. the cutting current for incising or excising - the coagulation current for hemostasis or mass destruction of tissue.

These different surgical effects are governed by certain fundamental principles which will be discussed in detail in the following sections.

ELECTRO-CUTTING

If a current of proper wave form, voltage, amperage and continuity of energy is applied to tissue through a suitable electrode, a small intense arc will form between the electrode and the tissue -- a small zone of tissue cells will be destroyed and, volatilizing, will pass off as vapor -- and as the electrode moves along, the tissues part as those severed by the sharpest scalpel. As the electrode passes through, the heat of the arc creates on the severed edges a shallow zone of dehydrated tissue -- there is an actual drying out or coagulation of superficial cells -- and this dehydration seals off the capillaries and smaller blood vessels and prevents bleeding and oozing from these sources. The (relatively) reduced hemorrhage that follows electro-cutting is due directly to the dehydrated tissue remaining on the edges of the wound.

The degree of hemostatic effect secured with electro-cutting -- the size of blood vessels that will be occluded -- depends directly on the depth of dehydration remaining on the wound edges. The more dehydration, the more hemostatic effect. The less dehydration, the more bleeding.

The depth of dehydration (and consequent hemostatic effect) can, within certain limits, be controlled by the surgeon. It is a variable factor that can be governed to best suit the immediate conditions.

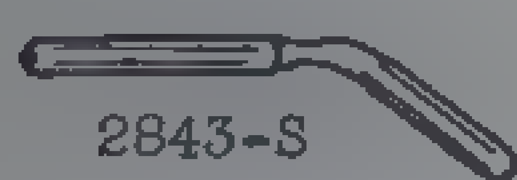
The amount of dehydration on the edges of the wound depends on;

A - AMOUNT OF POWER USED. With a given electrode and for a constant speed and depth of cut, higher power will produce more dehydration than lower. One exception to this, however, should be noted. If a cut is attempted with too little power the electrode will start to cut with difficulty, will continue to cut slowly, and in so doing, will leave considerable dehydration on the edges of the wound.

B - SPEED OF CUTTING. With a given electrode and for a given power setting the depth of dehydration on wound edges can be partly controlled by the speed of cutting... Under otherwise identical conditions, the slow cuts produce more dehydration than fast.

C - TYPE OF ELECTRODE USED. The thinner the entering edge of the electrode (under otherwise identical conditions) the less dehydration is produced on the wound. Other conditions remaining constant, the small flat blade produces the minimum of dehydration on the severed edges of tissue. This electrode should always be used for skin incisions if primary union is expected. The large flat blade produces somewhat more drying out on the wound edges than does the small blade; the small needle produces more than the large blade and the large needle still more. The most useful cutting electrodes are shown below.

2840-S



2843-S

SMALL FLAT BLADE -- straight and angulated. About .0115" thick. Cuts freer and with less dehydration than any other electrode. Should always be used for skin incisions, and cutting through thick fat or cartilage.

2840-L

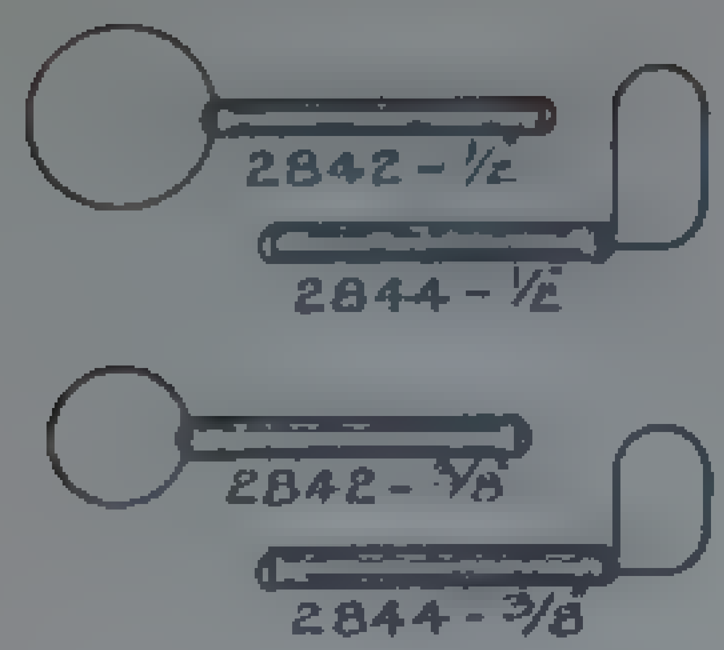
LARGE FLAT BLADE -- Leaves somewhat more dehydration than small blade. Used for dissection where a moderate amount of dehydration on wound edges is tolerable, i.e., in muscle or gut. Do not use for skin incision, or in thick fatty tissue or cartilage.

2841-S

SMALL NEEDLE--.017" in diameter. Leaves somewhat more dehydration on wound edges than the large blade. Do not use for skin incisions or dissections of fat or cartilage. Must be used with caution in muscle or gut when primary union is expected. Ordinarily used when primary union is not involved,e.g.,in dissection of brain tumors or malignancies where the wound is left to granulate.

2841-L

LARGE NEEDLE -- About .0275" in diameter. Cuts less freely,requires more power and leaves more dehydration on the wound than any other electrode.Should never be used for incising skin and other tissue if primary union is expected. Used principally where very heavy dehydration and maximum hemostatic effect is wanted, e.g., in opening lung abscesses, dissection of the more vascular brain tumors, or removing lesions where the wound will be left to granulate.Especially useful for dissecting in highly vascular areas such as the lip, tongue, cervix, etc., as its use results in minimum hemorrhage (maximum dehydration).



LOOPS, ROUND, AND OVAL -- those most extensively used are 3/8" and 1/2" in diameter, although other sizes -- larger and smaller -- are available. Made of wire approximately .018" in diameter. Used for "scalloping out" pieces of tissue, e.g.,the piecemeal removal of brain tumors,taking a biopsy specimen, piecemeal removal of lesions of the tonsil, uvula, roof of mouth, rectum, etc. Fairly high power is required with loops due to relatively large area of electrode contacting the tissue.

On one model, i.e. The Improved Davis-Bovie Unit (as well as the Original Model Davis-Bovie and Model U, neither of which are now in production), provisions are made in the electrical circuits for varying the dehydration characteristics of the cutting current so that the surgeon can select a current that produces greater or less dehydration (and hemostatic action) <u>without changing electrodes</u>. This is accomplished by means of a dehydration control on the cutting circuit. In the former models three different degrees of dehydration could be produced on the wound edges with any given electrode. The positions on this Dehydration Control on previous models were marked LIGHT - MEDIUM - HEAVY - indicating the relative degree of dehydration that would result from each setting.

With the new Improved Model Davis-Bovie there are five steps of cutting current hemostasis. Thus, in addition to changing electrodes, the surgeon has the means for still further changing the dehydration characteristics of the current. With the Davis-Bovie, if thick electrodes are used with the "Heavy" setting, or on the Improved Unit - steps 4 or 5 of the Cutting Current Hemostasis Control, a very powerful hemostatic effect can be secured, permitting cuts through vascular structures with little, if any, hemorrhage. Experimentally, with the large needle and maximum dehydration, incisions have been made in a dog's liver with no bleeding. The use of such heavy dehydration will, of course, be limited to those applications where primary union is not involved.

PRIMARY UNION

The amount of dehydration tolerable on the edges of a wound is very intimately tied up with the question of per-primum healing. Primary union is directly affected by the amount of dehydration on the tissue edges -- the less dehydration, the less interference with primary healing.

The dehydrated necrotic cells remaining on the wound are, in effect, foreign bodies and while they can be absorbed to a certain extent, if the amount of dehydration necrosis is beyond the absorption powers of the tissue, then a slough will result and healing may be delayed.

There has been considerable misunderstanding and concern expressed over the ability to secure per-primum healing following electro-surgical wounds. In the light of present-day experience we can say positively that primary union can be secured in tissue of any nature providing the proper technique is used. This means that the depth of dehydration remaining on the wound edges must not be more than the tissues can absorb. No specific rules can be given. The surgeon must learn from experience the amount of dehydration that can be absorbed in different tissue. At the outset however, where primary union is involved, it will be wise to play safe and use electrodes,set the power and cut at a speed that results in very little dehydration as this will avoid any difficulty with healing.*

Different kinds of tissue have varying abilities to absorb the dehydrated cells. In muscle, the intestines or the stomach,considerable dehydration will interfere little, if any, with primary union although healing is slightly slower than following equivalent scalpel incisions.

The skin, however, has very limited powers of absorbing this dehydration necrosis and in making skin incisions every precaution must be observed against leaving an excess of dehydrated tissue on the edges of the wound. This means that for skin incisions <u>only</u> the small flat blade should be used -- that the incision should be made rapidly, the use of excess power avoided.*

If these precautions are carefully observed per-primum healing comparable to that secured following a scalpel incision can be obtained with the cutting current....

* [illegible]

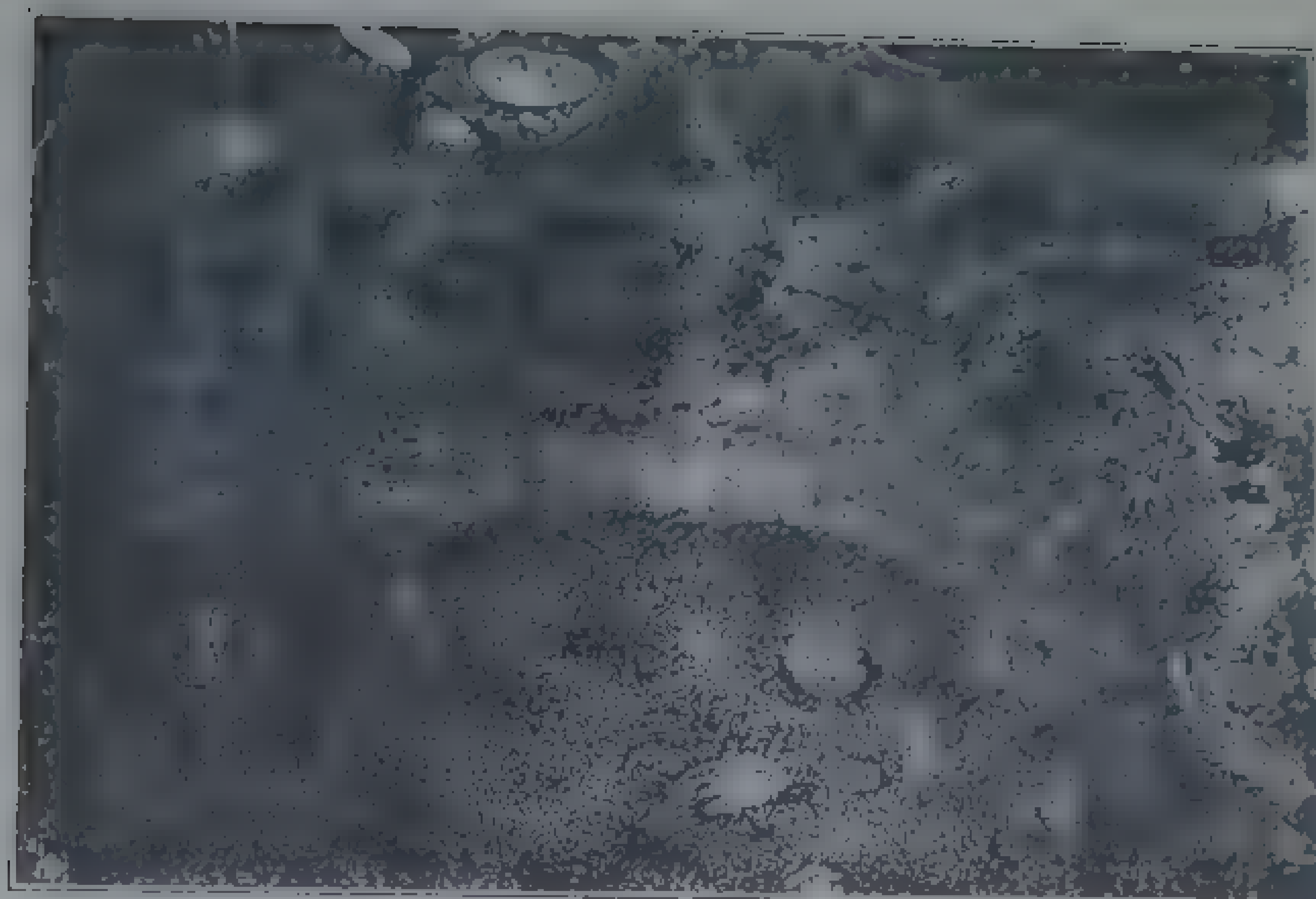


FIG. 20—PHOTOMICROGRAPH OF TWENTY DAY HEALING IN DOG'S LIVER, *after wedge-shaped resection with Bovie Unit using light dehydration. The removal of necrosed parenchyma cells is complete. The collapsed lobular framework and scarring contains unaffected cells and is being invaded by regenerating hepatic tissue. There is still some foreign-body reaction, with macrophages, about the two black silk mattress sutures used for closure of the cleft.**

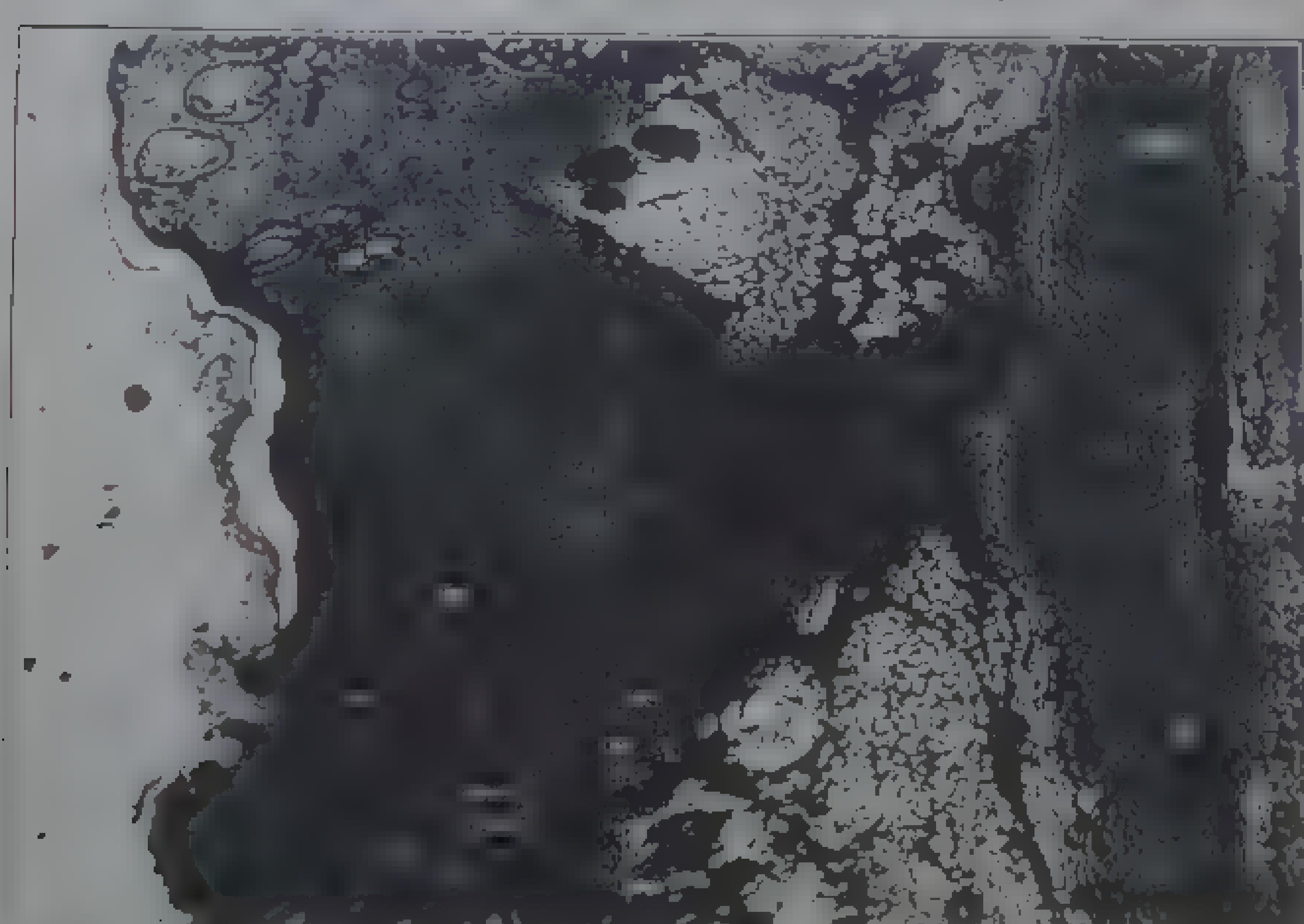


FIG. 21—PHOTOMICROGRAPH OF EIGHTEEN DAY HEALING, *after skin incision with Bovie Unit using heavy dehydration. Healing was per primam, the scar is 1.8 mm. broad.**

**Reproduced by permission of the American Medical Association*

Muscle will absorb considerably more dehydrated tissue than skin. Thus, in making incisions through muscle, it is permissible to use the larger blade electrode or to cut somewhat slower so that more dehydration and less bleeding results.

In heavy adipose tissue care must be taken to avoid a boiling-out effect for this will interfere with union. Incisions through heavy fat should be made only with the small flat blade, considerable power should be used, and the cuts should be made rapidly*. A succession of rapid shallow cuts is better than one deep incision as this also minimizes the "boiling-out" effect.

It has been observed that electrically produced wounds during their healing period, excrete considerably more serum than does a corresponding scalpel incision. While there is no more tendency to infection, there is a free flow of serum for several days after the incision and on large wounds (for example, a thoracoplasty or radical breast amputation) drains may be necessary for a somewhat longer period than if a scalpel were used.

The healing of wounds produced by the electrical cutting current in tissue of any nature takes place slightly slower than a corresponding scalpel wound. The studies of Ellis reported in the Journal A.M.A. for January 3rd, 1931, under the title "The Rate of Healing of Electro - Surgical Wounds as Expressed in Tensile Strength", indicate that healing of electro-surgical wounds is about two days slower than a corresponding scalpel incision and that during the mid-point of healing, these wounds are of slightly lesser tensile strength.

Skin incisions made with the electrical cutting current tend to show slightly more scarring than a scalpel incision and this fact must be considered in operations where cosmetic results are important.

There are, of course, many operations where primary union is not involved - such as the excision of a malignancy where the wound is left to granulate -- cervical conization -- the excision of brain tumors, etc. and in such cases electro-cutting appears at its best for an electrode can be selected and a technique used which results in the minimum of hemorrhage.

PRECAUTIONS. In working around bony structures care should be taken to avoid damaging the periosteum, for any

*[illegible]ipped with [illegible] Dehydration, use [illegible] "Light" or No. 1 setting.

coagulation or burning of this membrane may result in necrosis of the underlying bone with separation of sequestra and healing would be extremely slow.

Sometimes when striped muscle is severed with the cutting current there is an annoying twitch when the current is applied. This is not due to any electrical sensation but is apparently caused by the intense heat of the arc which reacts on the motor nerves in the operating field. This twitching can be kept at a minimum,if not completely eliminated, by using the least possible power. Excess power aggravates this twitching effect. It can be further reduced by maintaining traction on each side of the line of incision so that the muscle is under tension while cutting proceeds.

While it is physically possible to do electrical cutting under almost any condition, we do not advocate its use unless there is some clear cut reason for so doing. That it will ever replace the scalpel and scissors in routine surgery we do not believe. Electro-cutting is of distinct value in the presence of malignancies or badly infected fields. It is very useful in big operations, i.e. breast amputations, thoracoplasties, etc. where it effects a material reduction in hemorrhage and saves time for this reason. It offers many advantages in hard-to-reach cavities, e.g., the mouth, rectum, vagina, deep-lying brain tumors,for with suitable instruments such operating fields are easily approached. It occupies a distinct and unique field when used through various endoscopic instruments; resectoscopes, thoracoscopes, laryngoscopes, etc.

In some cases electro-cutting may be distinctly hazardous. For example, if it were used for opening the peritoneum (and we can see no conceivable reason for doing so) the chance of rupturing the intestine would be increased, for with the current on,anything the electrode touches will be cut, or at least burned. In the proximity of large blood vessels, as in axillary dissections,this danger must be kept clearly in mind, for just a light contact or even a small spark jumping from the electrode may do irreparable damage.

From the foregoing it can be seen that the decision to use or not to use electro-cutting in any given operation must take into consideration the advantages and disadvantages of the method -- the pros and cons must be carefully weighed -- and when electro-cutting is done the surgeon must carefully consider the factors of dehydration, primary union, possibilities of damaging adjacent structures, etc.

POWER REQUIRED FOR ELECTRO-CUTTING varies through wide limits, depending on the type of electrode used, nature of tissue being cut, speed and depth of incision. For definite guidance the surgeon should refer to the instruction book accompanying the particular machine in use. There are, however, certain generalities that may be observed.

> TYPE OF ELECTRODE USED. The thicker the entering edge of the electrode, the more power is required, for a given speed and depth of cut.
>
> NATURE OF TISSUE. Hard dry sclerotic tissue, fat or cartilage will require somewhat more power than softer or moister structures which offer less electrical resistance to the current. In a very moist bloody field, however, considerable power may be required to offset current lost through the fluid medium.
>
> SPEED AND DEPTH OF CUT. The faster or deeper a cut is made, the more power is required.

The surgeon should learn that power is a variable factor that should be adjusted to best meet the immediate condition. In actual operative work occasional re-setting of the power control may be required, to meet the needs of faster or deeper cutting, different kinds of tissue, etc.

There is one safe general rule that applies to all conditions, namely,

> USE THE LOWEST POWER THAT CUTS FREELY TO THE DESIRED DEPTH IN THE TISSUE BEING SECTIONED.

If lowest possible power is used it will avoid undue sparking and flashing at the electrode, will prevent excess dehydration or carbonization of the wound edges, will prolong the life of operating electrodes.

Experimentally, the proper power setting for your machine under your particular conditions can be determined by meat tests as outlined later.

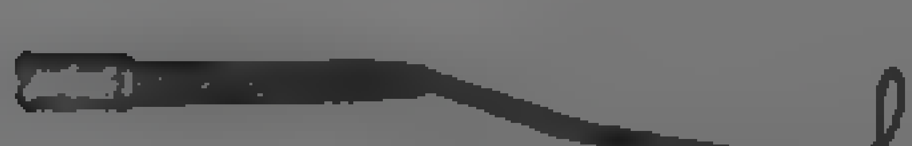
> NOTE: Electrical cutting should always be done by the bipolar method; that is a large indifferent electrode should be applied to

the patient's bare skin. Under certain conditions it is physically possible for the surgeon to cut without an indifferent electrode, but this is not recommended for general use. For a given depth of incision it requires a great deal more power to cut without an indifferent electrode (monopolar) than it does with the bipolar method. Also, if an indifferent electrode is not used a direct current path is not provided through the patient and there might be a tendency for the current to "leak out" through the operator. For these reasons we recommend that cutting always be done by the bipolar method.

In actual operative work coagulated blood and dried out tissue clings to the operating electrode which must be cleaned off from time to time. Unless this adherent tissue is removed from the electrode, cutting is interfered with. It can be cleaned off by wiping with a sponge, by scraping with the back of a scalpel or by means of a small ball of bronze wool. Steel wool should not be used as pieces tend to break off and be carried into the operating field.

UNDER WATER CUTTING can be carried out as readily as in air providing proper instruments are used. Cutting under water requires that a part of the electrode be insulated and only part of the active tip exposed. Water is an excellent conducting medium and if any large area of the electrode is exposed, so much of the current will "leak off" through the water that there simply will not be enough power left to cut. It is useless to attempt under water cutting with an ordinary needle, knife or loop electrode. This leaves too much area exposed for leakage.

Stern-Davis Loop



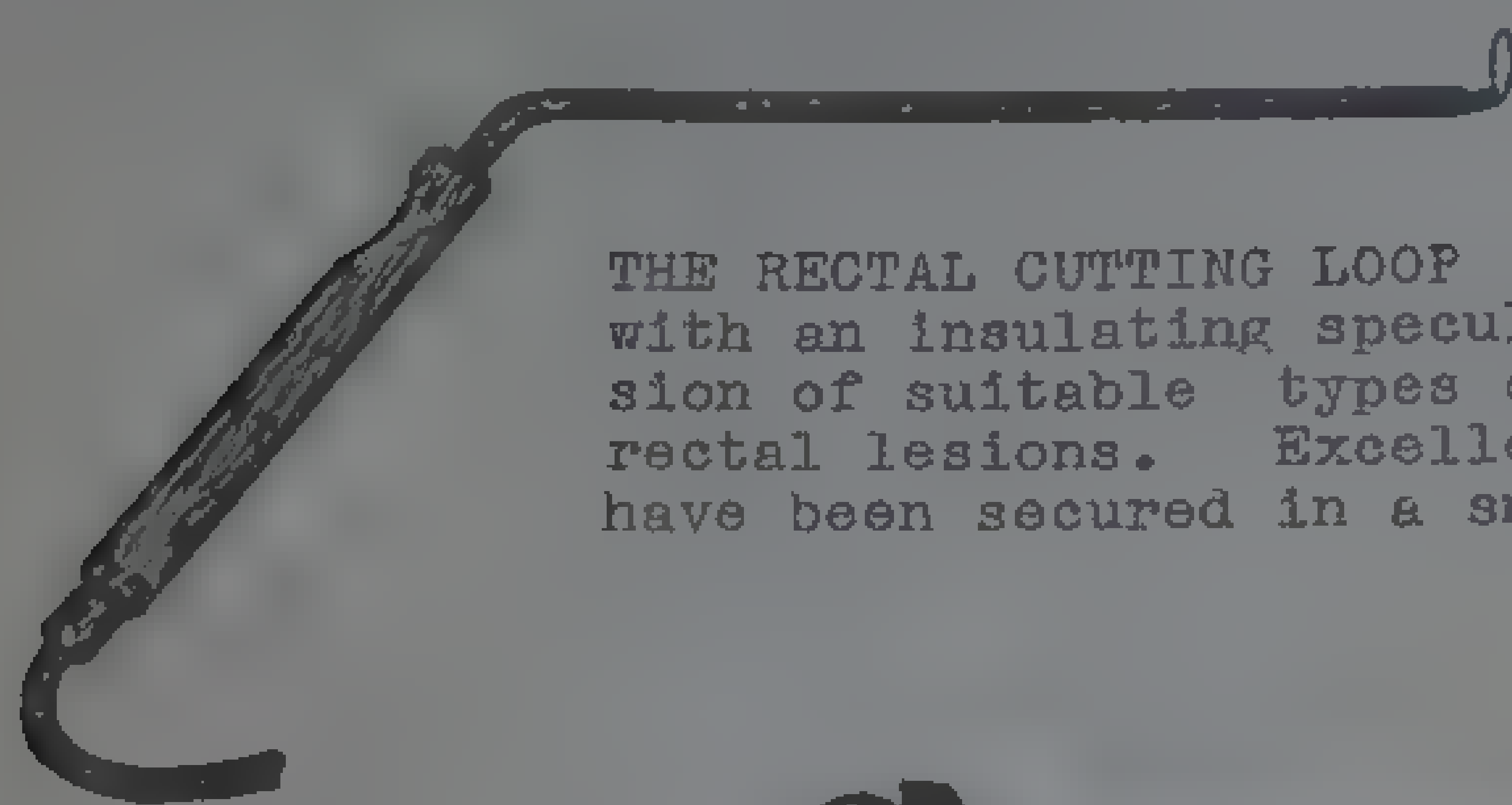
Stern-McCarthy Loop

Ordinarily the electrodes used for under water cutting are special loops that fit into the prostatic resection instruments such as the Stern-Davis and McCarthy loops illustrated.

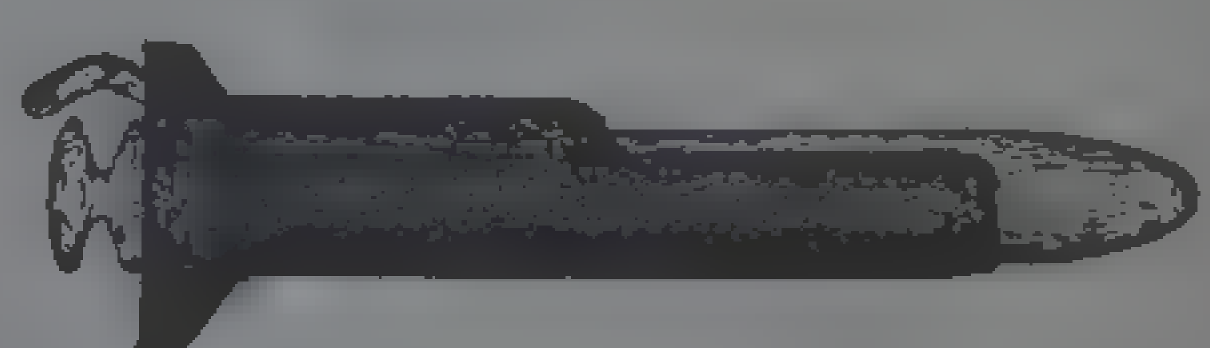
Other special under water electrodes have been devised for incising the ureteral orifice, incising median bars, etc. and are used to a limited extent.

SPECIAL OPERATING INSTRUMENTS

A number of instruments have been devised to meet the needs of specialized operative work. Some of these are illustrated and briefly described in the following.



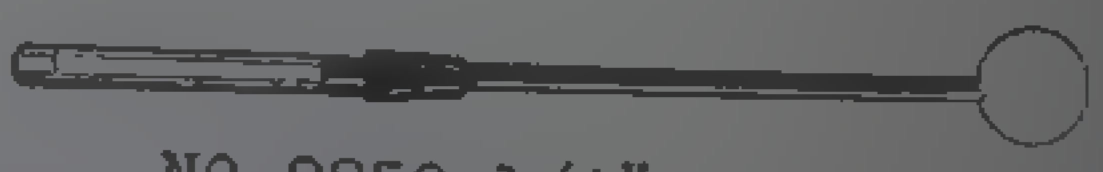
THE RECTAL CUTTING LOOP is used in connection with an insulating speculum for piecemeal excision of suitable types of low-lying obstructive rectal lesions. Excellent palliative results have been secured in a small series reported on.



INSULATING BAKELITE SPECULUM with sucker tube (which is connected to any suction machine) for evacuating smoke, fumes, and debris -- illustrated with obturator in place.

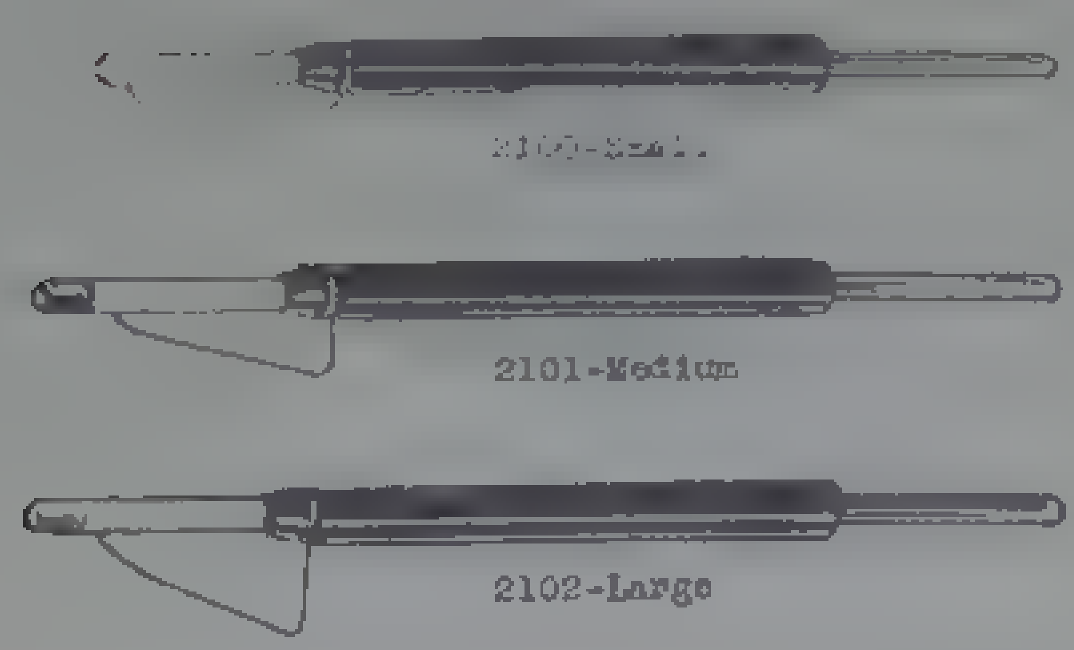
NEURO-SURGICAL CUTTING LOOPS AND NEEDLES are mounted on an extra long shaft to permit easy attack of deep lying intra - cranial tumors. The active part of these special electrodes is made of an iridio-platinum alloy which cuts smoother and to which tissue does not adhere.

NO.2851-5/16"



NO.2850-1/4"

NO.2852

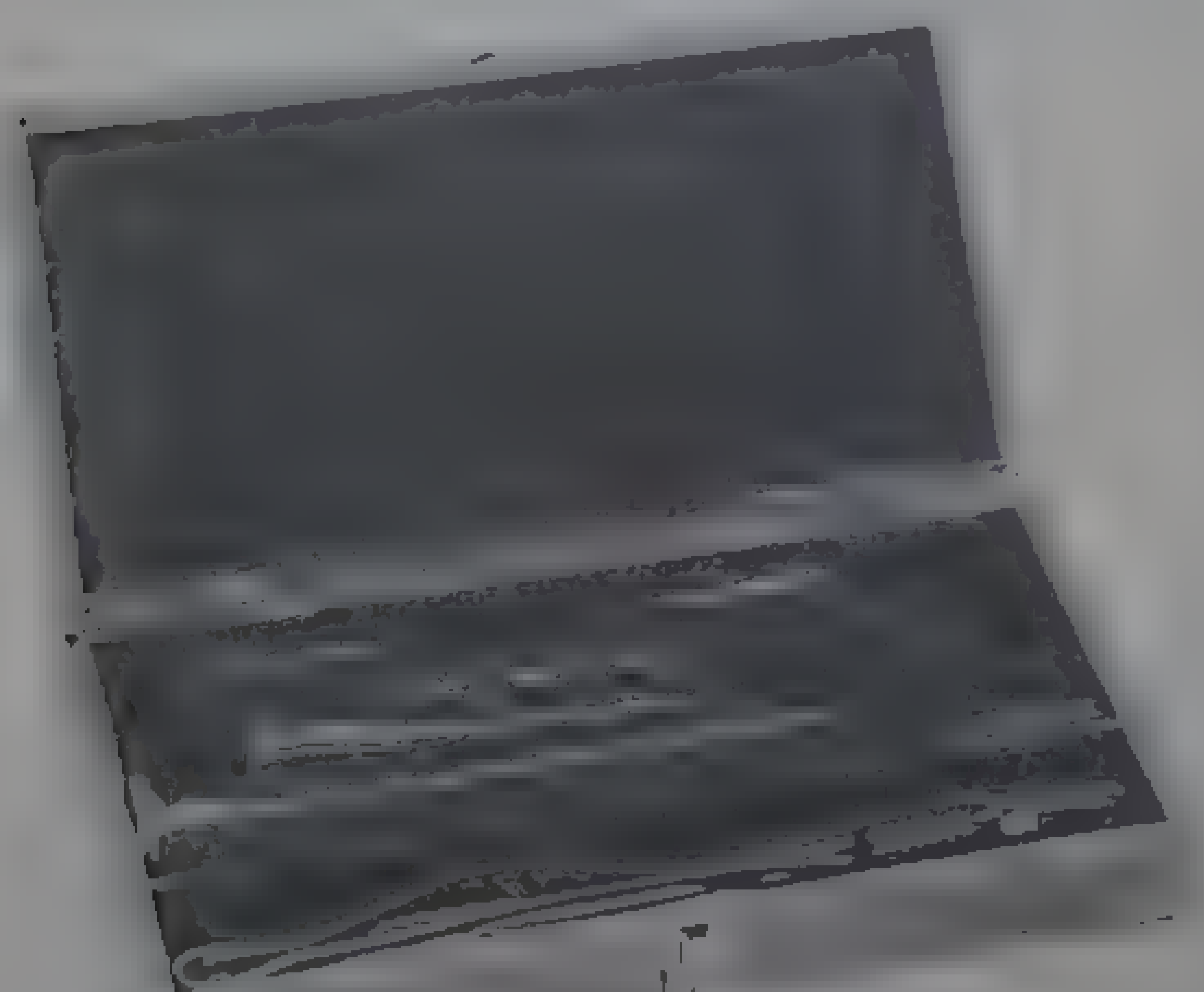


CERVICAL CONIZATION ELECTRODES, especially designed for the excision of tissue from the cervix and endo-cervix. Power required will vary in a wide range depending on depth electrode is inserted and amount of tissue to be removed.

Dr. Julian A. Moore's

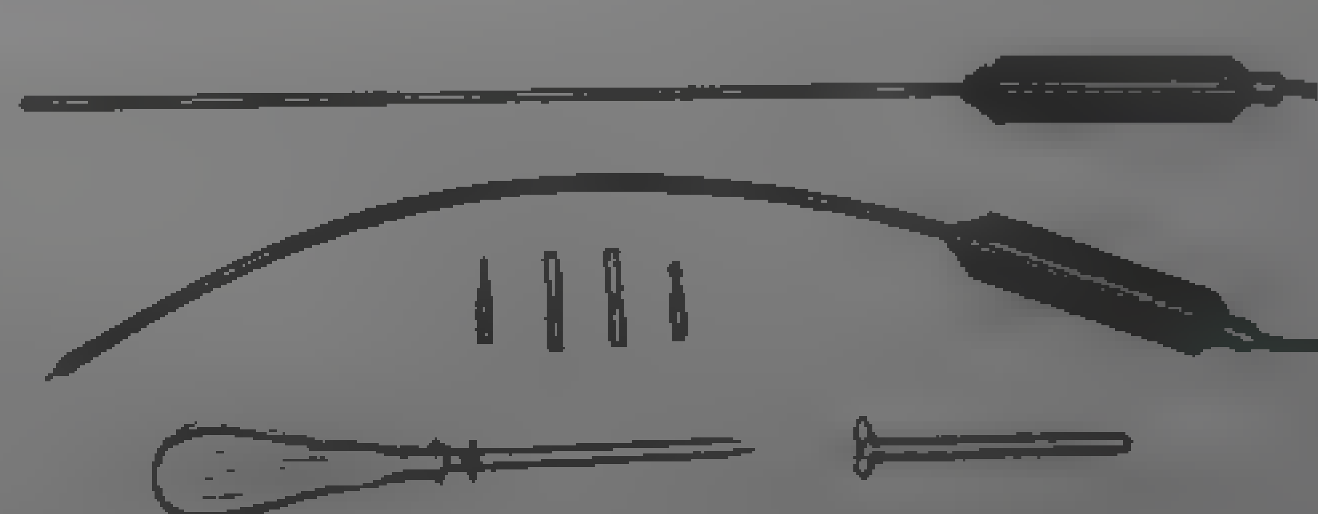
INTRA-THORACIC OPERATING INSTRUMENTS

For Severing Adhesions in Artificial Pneumothorax by Electro-Surgical Methods

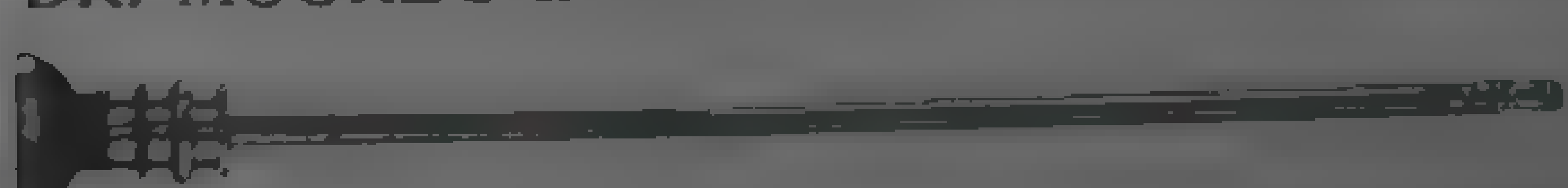


A simple, moderately priced, yet effective set of instruments for closed Intra-Pleural Pneumolysis. Designed especially for use with the Bovie Electro-Surgical Unit. Following the general dimensions and contour of the Jacobaeus instruments, with necessary modifications for the electro-surgical method, they have proven quite practical and satisfactory for approach to and severing of pleuritic adhesions. Flexible cannula permits easy manipulation of the curved handle.

The complete set consists of: *1 Curved handle; 1 Straight handle; 2 Blade electrodes; 1 Pointed electrode; 1 Ball electrode; 2 Flexible cannulae; 1 Trocar; 2 High frequency cords. Price for complete set in polished, wooden carrying case (does not include the thoracoscope)*



DR. MOORE'S IMPROVED THORACOSCOPE



[illegible] brilliant illumination and wide visual field, the improved Thoracoscope, illustrated above, provides excellent vision with either Moore's or Matson's Intra-thoracic instruments.

ELECTRO-COAGULATION AND DESICCATION

—— GENERAL PRINCIPLES ——

This chapter will be of benefit to readers who have not already had experience with electro-coagulation.

If an electrical current flows through a substance which offers resistance to its passage, heat is generated within that substance. Electro-coagulation is accomplished purely by the heat thus generated within the tissues.

First, let us study the heating effects of the current when passed through any portion of the human body, between electrodes of equal size.

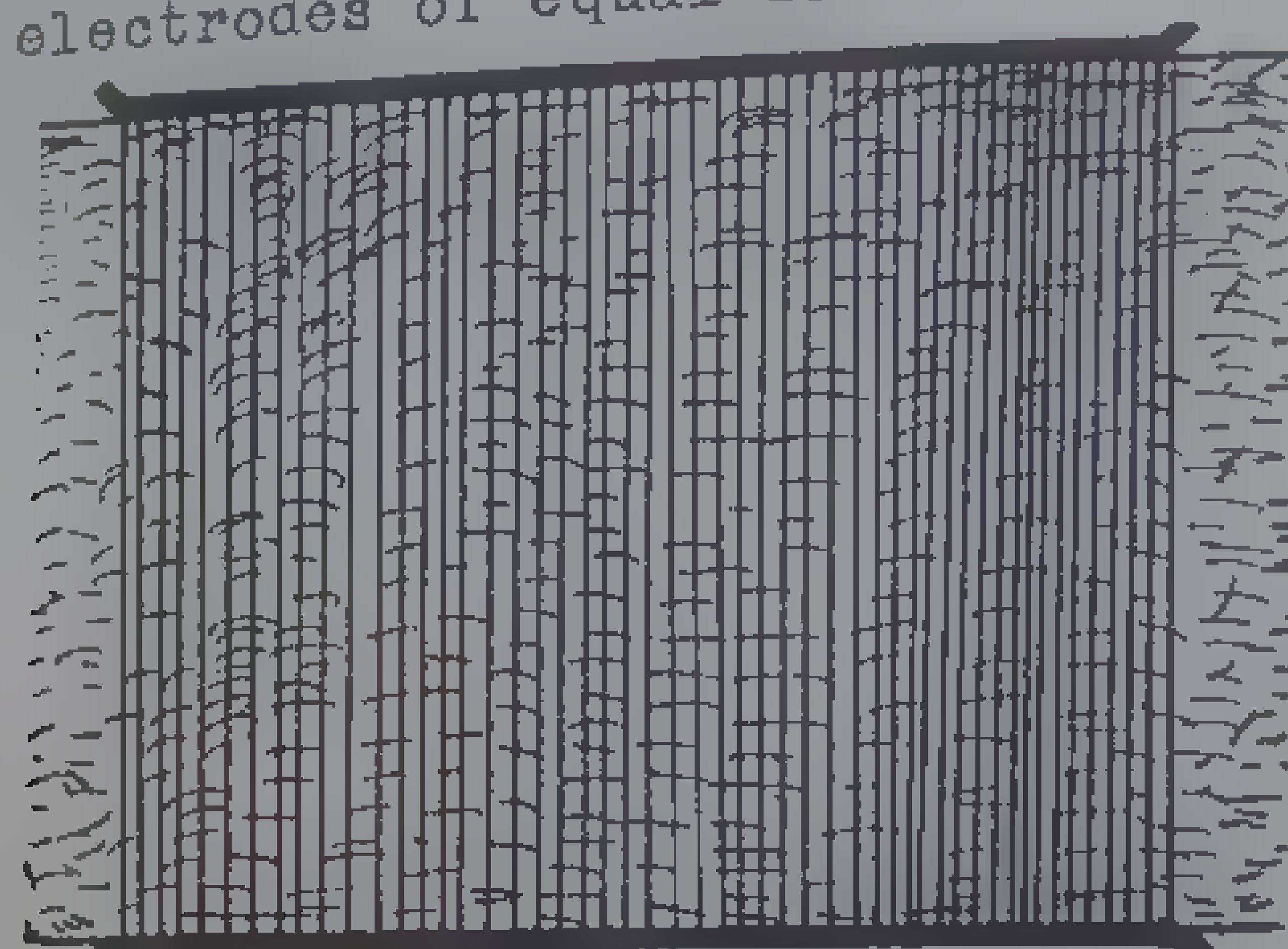


Fig. 1 illustrates the flow of electrical current between two equal electrodes and shows dispersion of current through the intervening tissue. The amount of heat produced by this current, in a given mass of tissue is dependent on:

a. The amount of current.
b. The length of time it is applied.
c. The area of electrode in contact with tissues.

Using electrodes of equal size, the heating effect produced is substantially uniform throughout the whole mass of tissue between the electrodes.

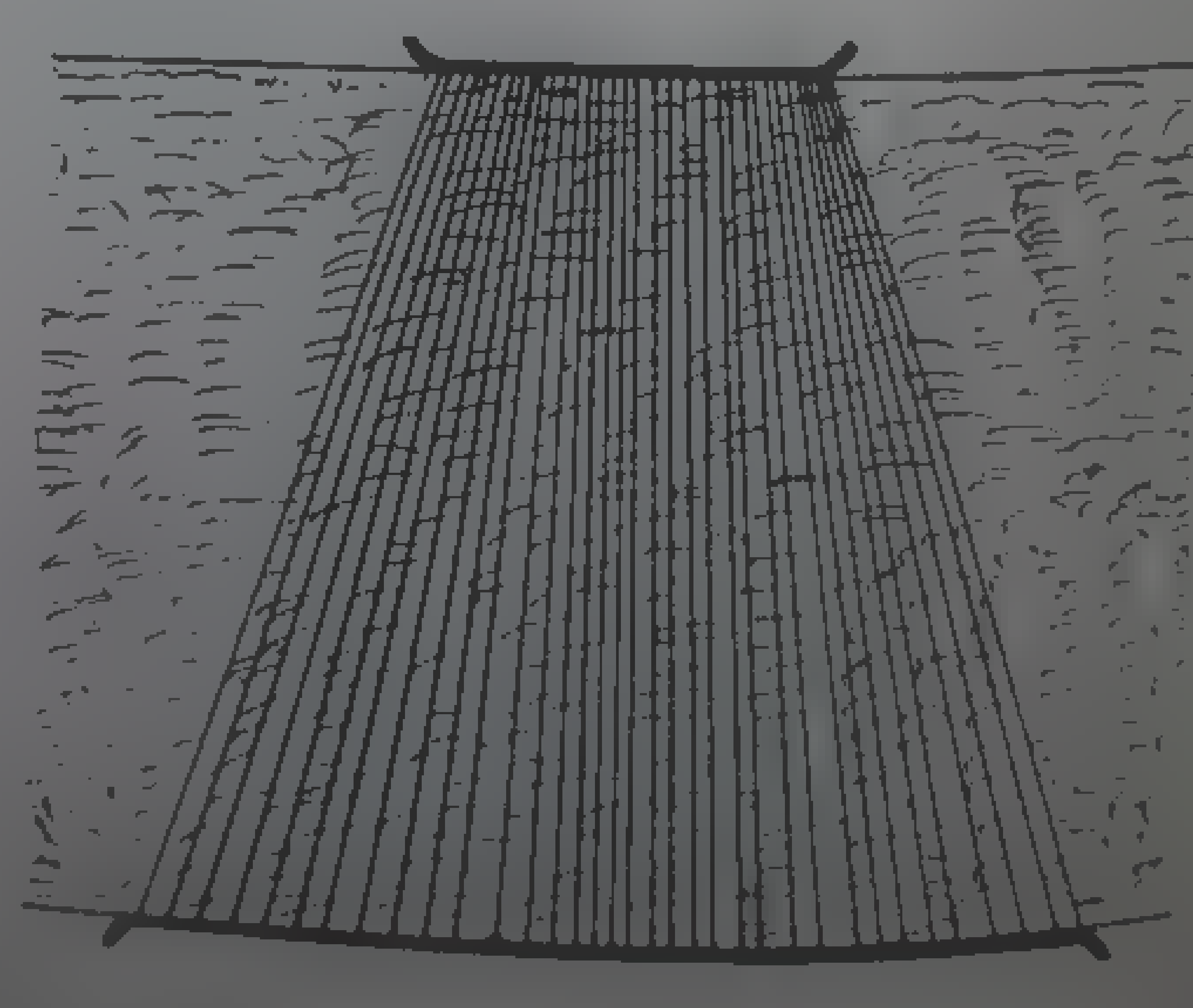


Fig. 2 illustrates the current flow through tissues between electrodes of unequal size. It will be noted that, in approaching the smaller electrode the current density becomes increasingly greater, with a corresponding increase in the amount of heat, until the current attains maximum density and greatest heat is produced at the smaller electrode.

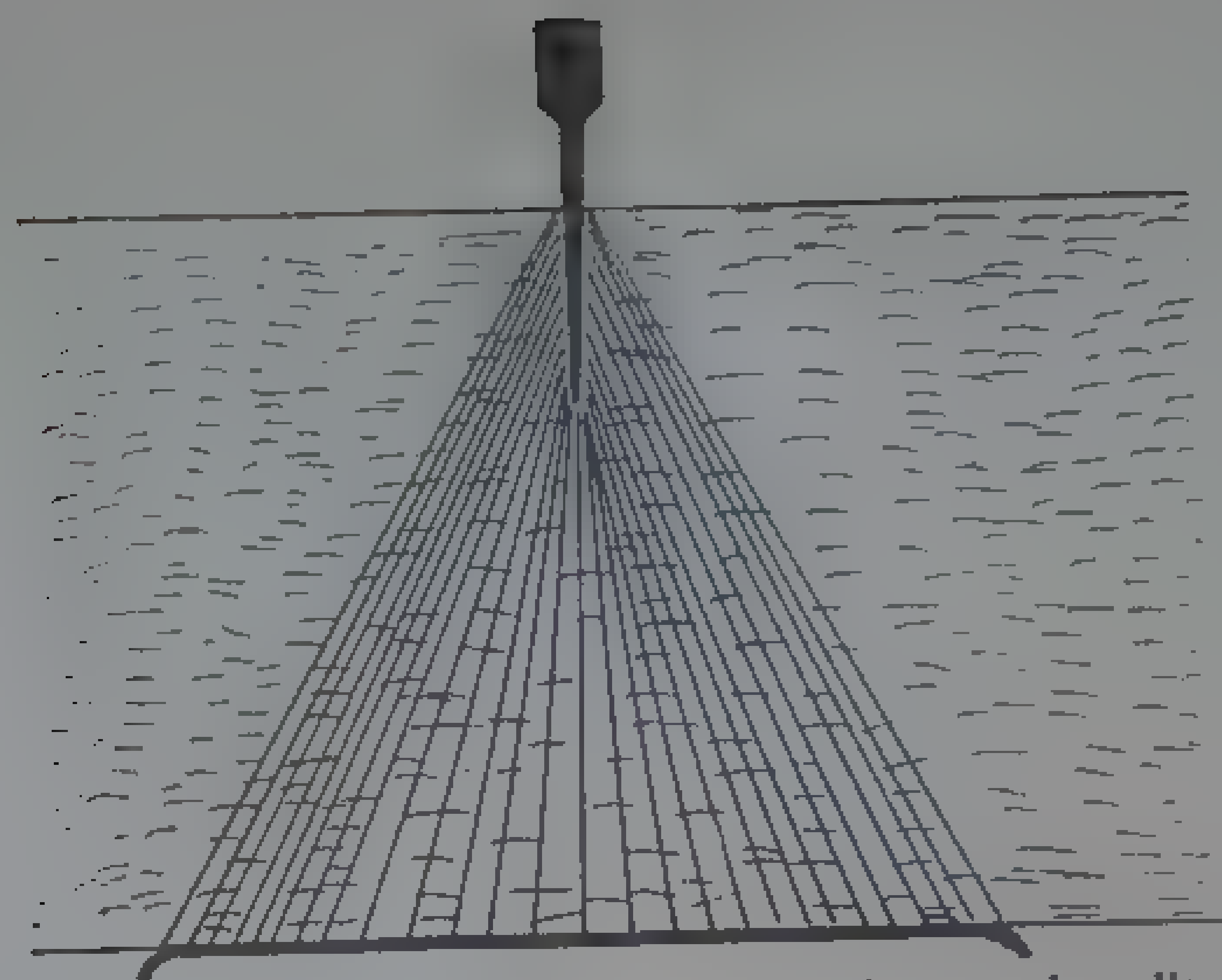
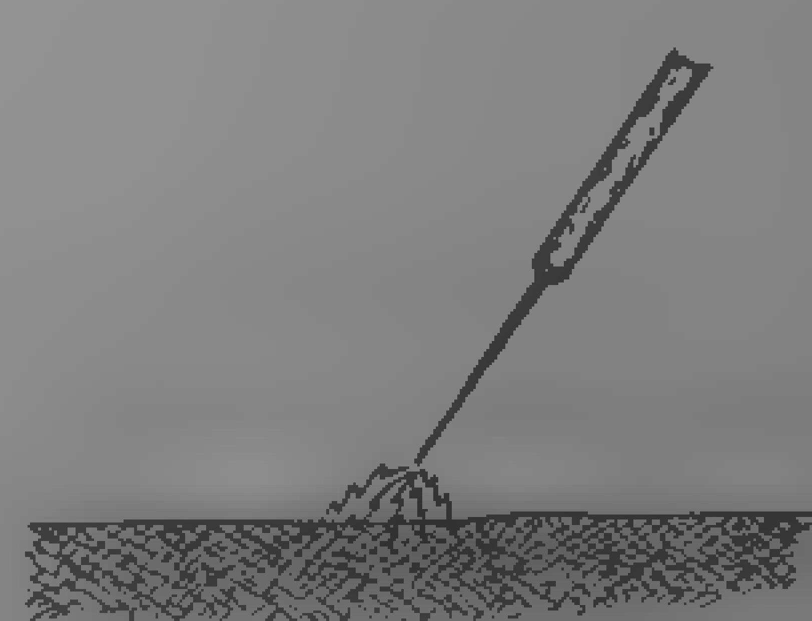


Fig. 3. Illustrating extreme current density around needle.

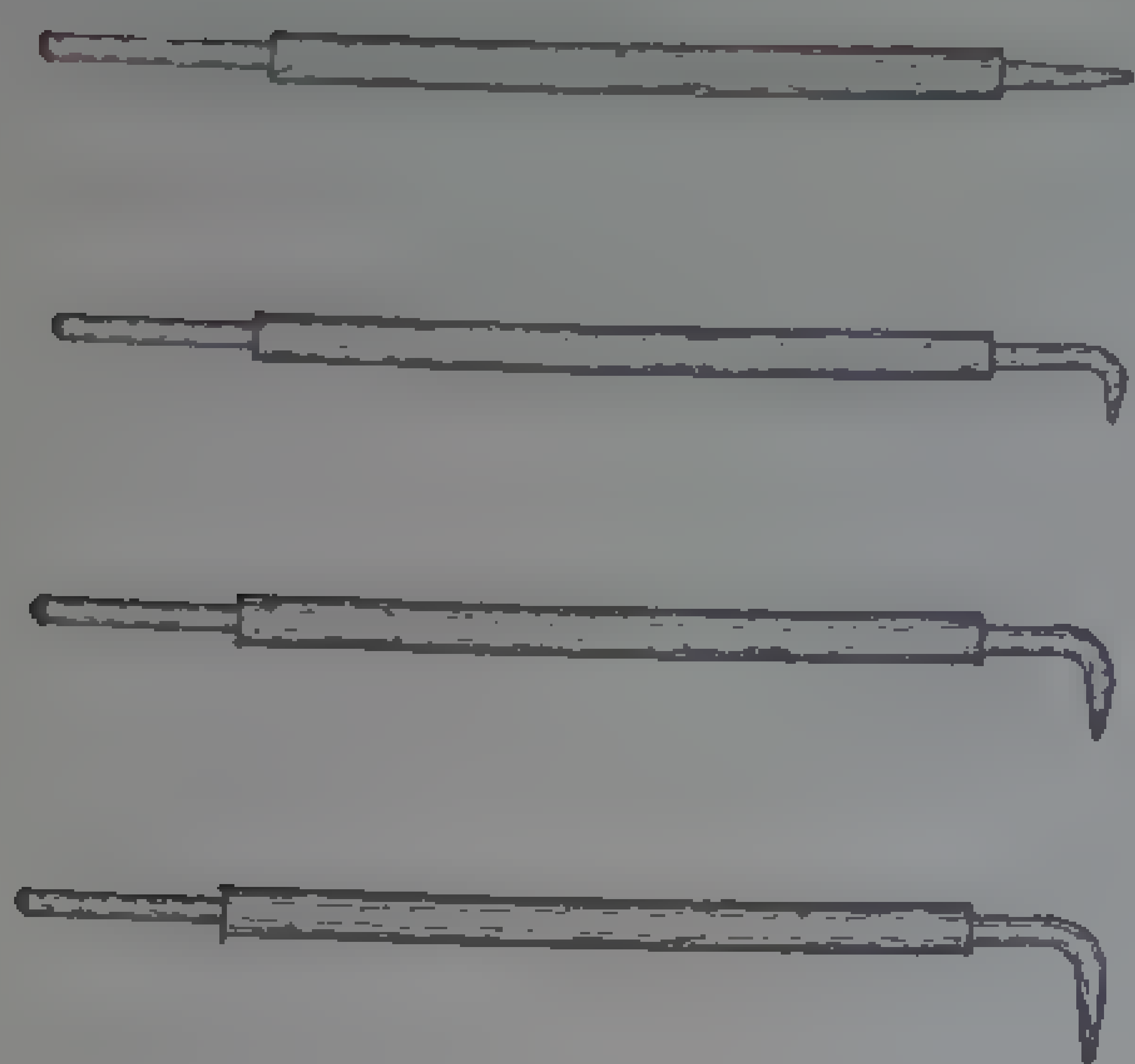
As illustrated in Fig. 3, if one electrode is very small and if enough current is applied for a sufficient length of time, enough heat is generated to coagulate or actually cook those tissues in the immediate vicinity of the smaller electrode. It is on the generation of an intense heat within the tissue itself, concentrated over a relatively small area, that the whole principle of electro-coagulation is based.

In electro-desiccation, where the current is allowed to spark over from the electrode to the tissue without actual contact, the current concentration and the effect secured is in general the same. However, the air space between the electrode and tissue introduces a relatively high resistance into the electrical circuit so that current intensity is considerably reduced and the destructive effect is largely superficial, without deep penetration.

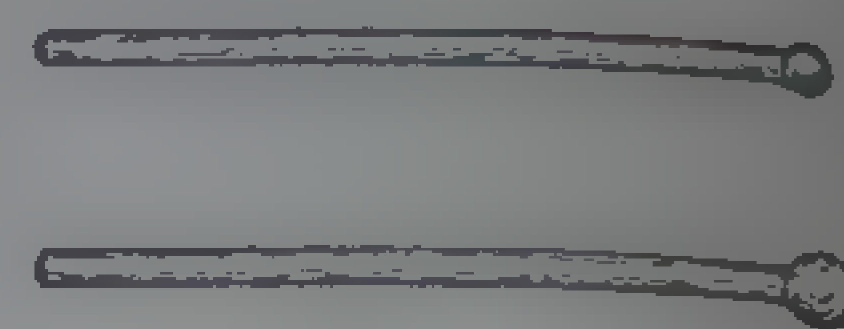


In modern electro-coagulation work, the smaller or active electrode is usually either a needle or small sized ball, or in electro-hemostasis, the tip of a hemostat. The actual

COAGULATION ELECTRODES

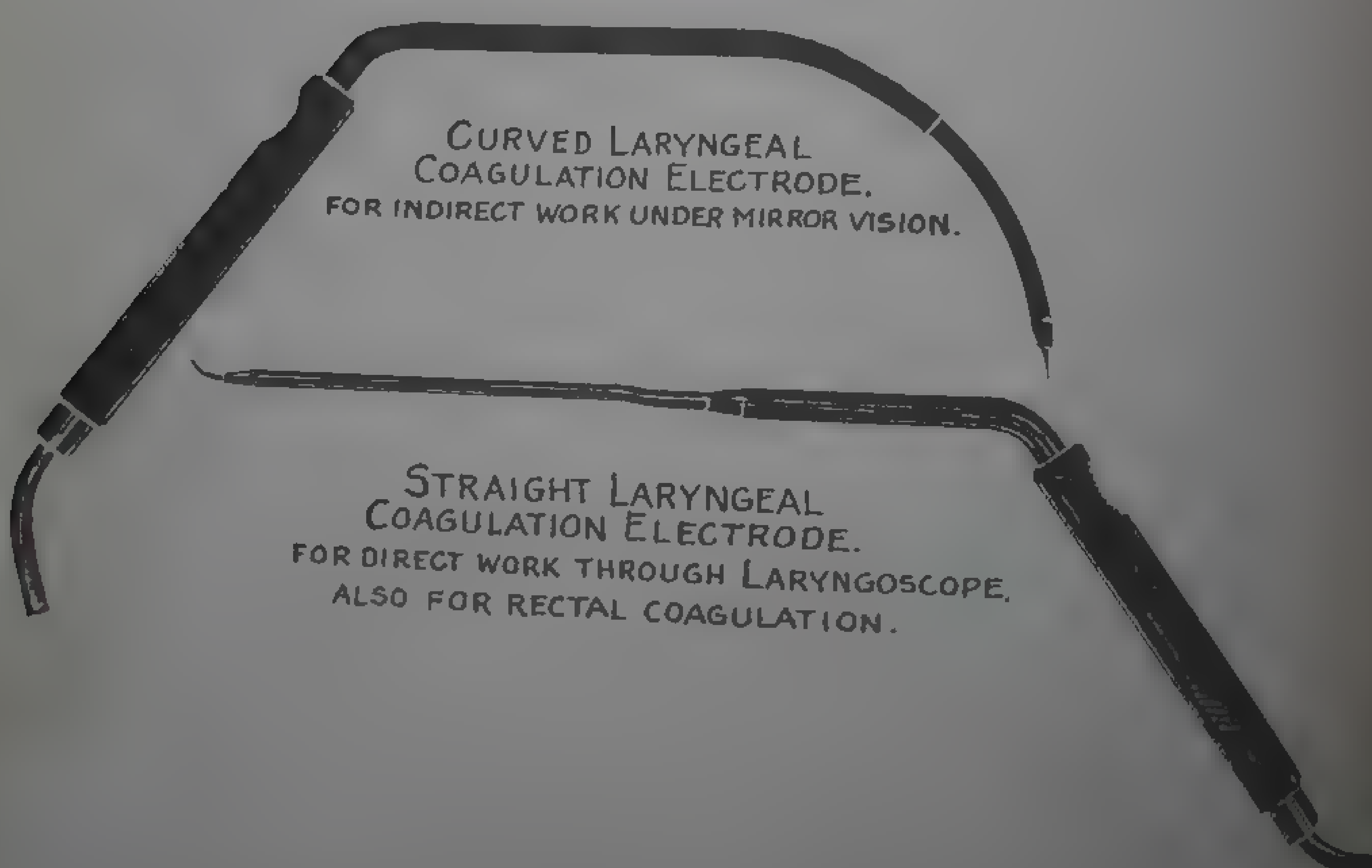


STAINLESS STEEL POINTS



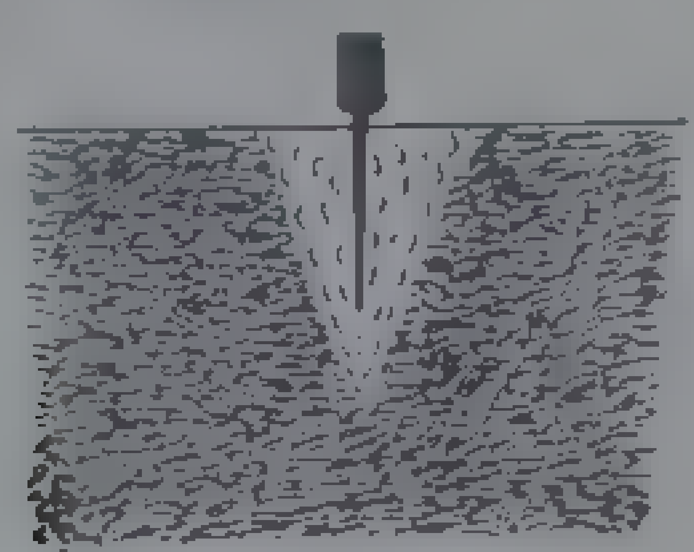
BALL ELECTRODES

NEEDLE ELECTRODES

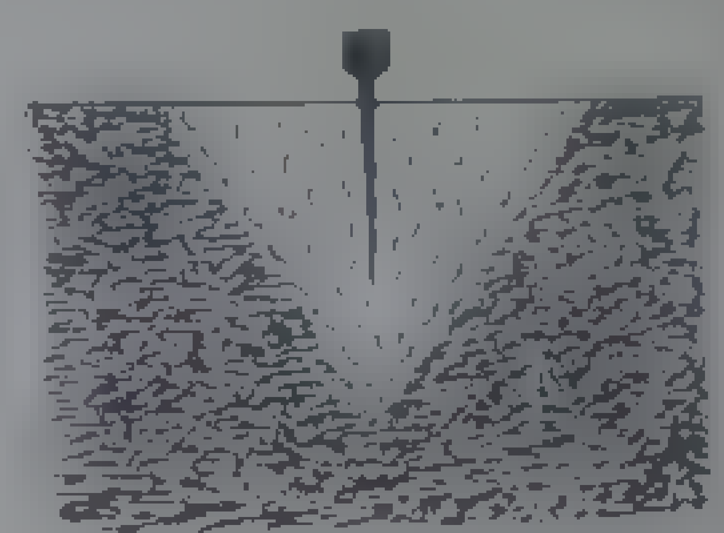


dispersion of the heating current is somewhat more complex than shown in the illustrations, due to the difference in electrical resistance of different types of tissue, but the same general principles hold good, viz: a concentration of current and heat in the immediate vicinity of the smaller (active) electrode, sufficient to coagulate or cook the tissue.

Contrary to what one would assume to be the case, a heavy current for a short time will not coagulate as great a mass of tissue as will a lesser power over a longer period of time. For a given area of electrode, a moderate amount of power applied for a few seconds will coagulate much deeper than will several times as much power for a correspondingly shorter period of time.



Coagulum around needle when heavy current is applied for short time.



Illustrating more extensive coagulum when moderate current is applied for longer time.

The reason for this is that with the lower current, the tissues in contact with the active electrode are not as rapidly dried out. They will secrete fluids which maintain a good electrical contact between the tissues and the electrode for a longer period of time, thereby permitting the current to be applied longer and coagulation carried to a greater depth. The heat generated will have time to disseminate into adjacent tissue.

Using greater current, drying out of tissues in contact with the electrode will be so fast that a high resistance to the current flow is introduced, thereby reducing the current strength and limiting the depth to which coagulation can be carried. If the current is still applied superficial carbonization around the electrode will result, undesirable sparking will take place and the current flow still further reduced.

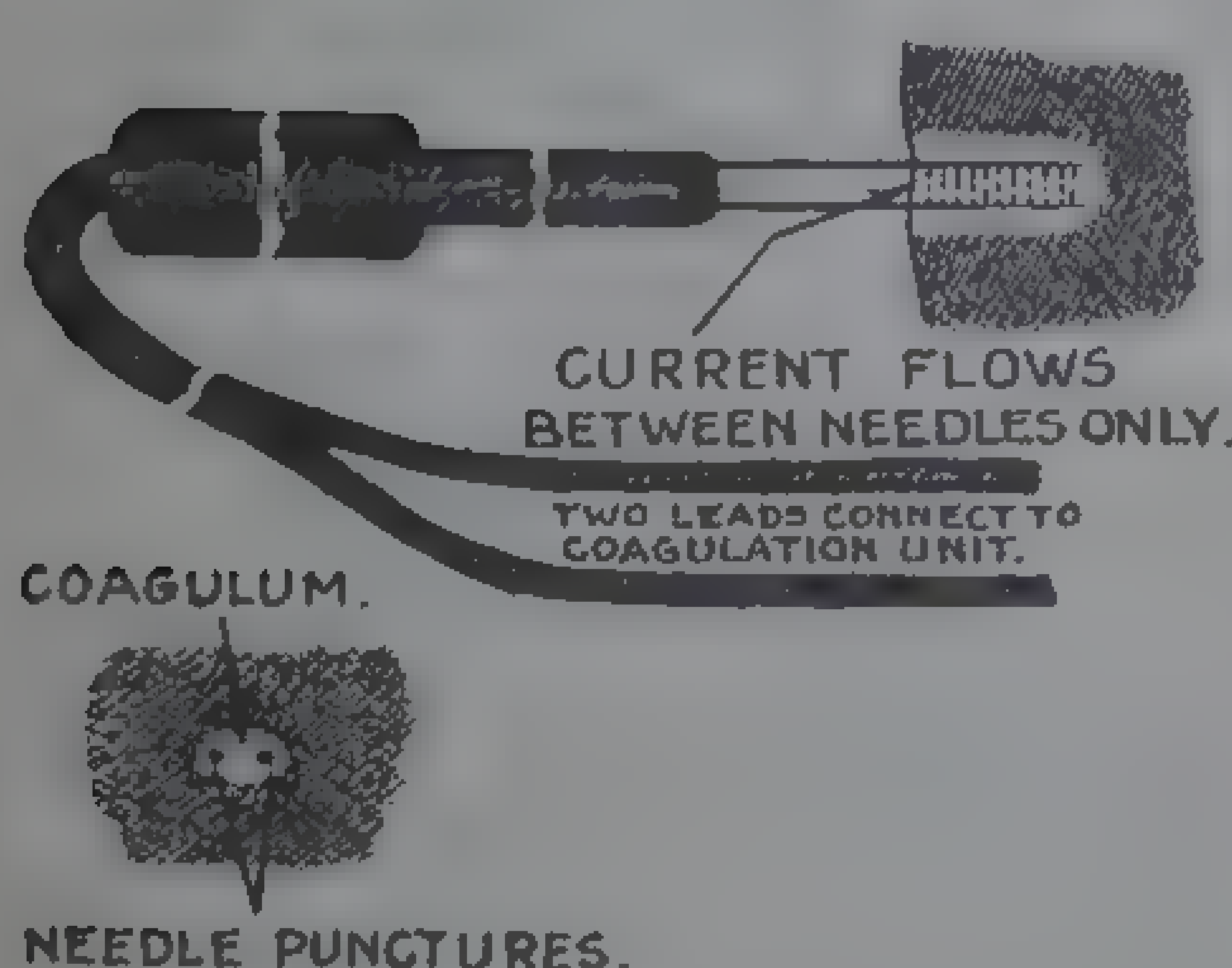
For these reasons, the results of coagulation depend largely upon the experience and judgment of the operator. Likewise, what takes place at the active electrode cannot be determined by any simple set of rules. We must depend on the skill.of the operator, who learns from noting how the tissues act in the immediate vicinity of the active electrode, just what is taking place, how much power to apply, and for how long.

Coagulation or desiccation results in the destruction of the tissue cells to which the current is applied.

These cells wil not regenerate. The coagulum so formed appears as a greyish white, dried out mass, which subsequently sloughs away. The length of time required for the entire mass to slough depends on the amount of tissue destroyed, varying from a few hours in the case of light superficial applications to several days where large masses of tissue are coagulated. When the destroyed mass has completely separated, dry healthy granular tissue appears below.

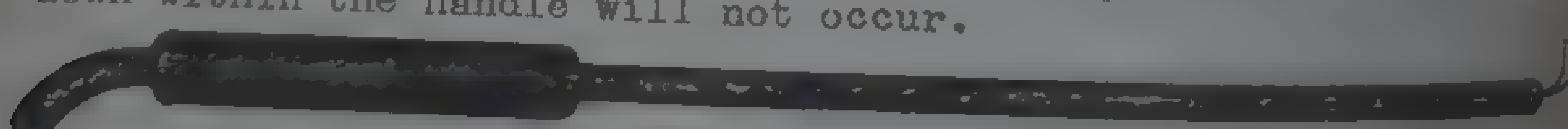
Bone cannot be coagulated. Cartilage will coagulate, but will be extremely slow in healing. When working around bone, care should be used not to destroy the periosteum. If this is destroyed, necrosis with separation of sequestra for a long period of time will follow. When dealing with certain malignancies and it is necessary to destroy bone, as much as possible should be removed with the ronguer to minimize the period of sequestration.

COAGULATION WITH BIPOLAR ELECTRODES

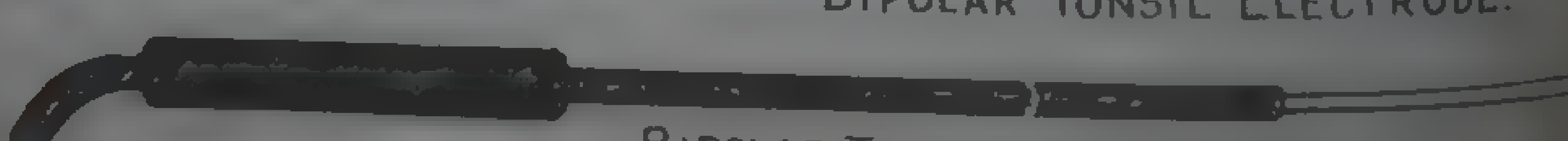


In recent years there has been a steadily increasing use of the so-called bipolar coagulation electrodes. In these instruments there are two needles or points, each connected to one of the terminals on the coagulation machine. No indifferent electrode is used as the two points are each, in effect, active electrodes. Coagulation takes place only between and around the two needles. While made in a wide variety of designs, the tonsil and turbinate electrodes, as illustrated, are the ones most extensively used.

Only a small amount of power is required with bipolar electrodes as the current penetrates only the tissue lying between the needles. Extreme care must be taken to avoid an excess of power so that arcing between the points or a breakdown within the handle will not occur.



BIPOLAR TONSIL ELECTRODE.

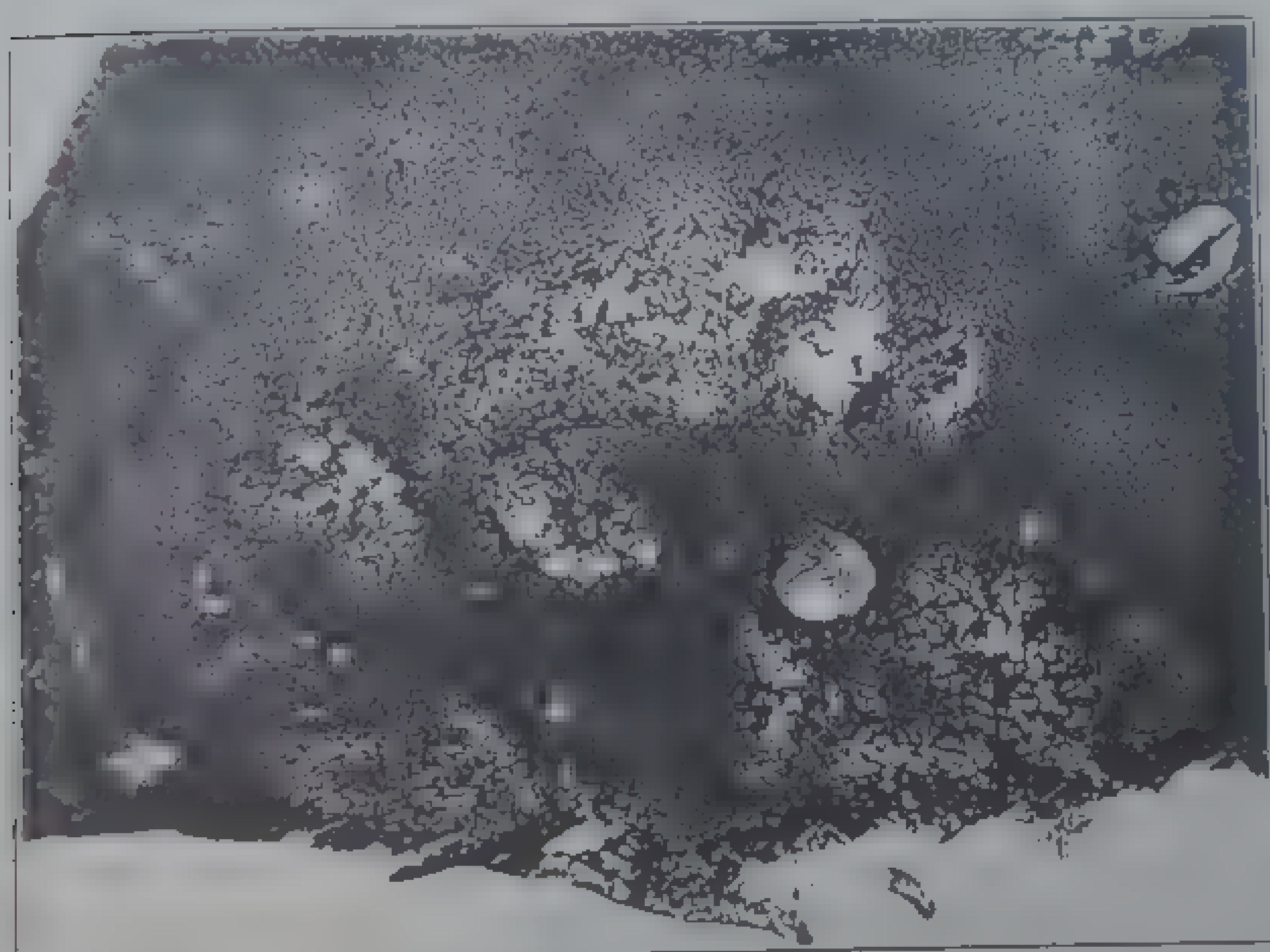


BIPOLAR TURBINATE ELECTRODE.

INDICATIONS

Briefly, electro-coagulation and desiccation afford means for hemostasis in major surgery and for destroying in almost any accessible mass of tissue. It is equally applicable to either large or minute growths. The process is absolutely accurate, easily controlled and simple to apply.

The heat, generated within the tissues, is sufficient to dry out the tissue cells, resulting in their death. Under the microscope a section of the tissue so treated will show the cells to be shrunken and shrivelled and their nuclei condensed, the whole presenting a mummified appearance.



PHOTOMICROGRAPH OF A CAT'S LIVER *after four seconds' contact application of coagulating current through a loop electrode. The absence of molecular dissolution in the middle of the surface is due to the adhesion of this zone to the electrode. Radial penetration of detectable histologic alteration is 2.8 mm. The shrinkage of the coagulum has freed some of the altered cells into a lake of plasma underneath it.**

**Reproduced by permission of the American Medical Association*

Macroscopically the treated tissue presents a greyish white, dried out and shrivelled appearance. The necrotic tissue eventually separates and the destroyed cells are replaced by connective tissue. Since this mode of cell destruction is associated with very little degenerative changes in adjacent healthy cells, there is a minimum of fibrous tissue as an end result. Scarring is soft and supple.

Thus these methods are extremely useful where good cosmetic results are essential, as in removing common skin [illegible]; or where hard scar tissue might result in functional impairment; as in working on the vocal cords, in the [illegible], or rectum.

Among the more common conditions where electro-coagulation or desiccation may be used to advantage are, pig-

mented nevi, telangiectases, leukoplakias, warts, keratoses. The precancerous dermatoses, including the various forms of keratoses, papillomata, x-ray dermatitis, lupus vulgaris and erythematosis, and other lesions of the skin and mucous membranes can be destroyed readily by this method.

Localized benign growths of the larynx, bladder or rectum; minor gynecological conditions such as cervical erosions and urethral caruncle; any area with malignancy if not too extensive; these are conditions indicating removal by electro-coagulation or desiccation.

In recent years many specialized uses such as sealing bleeders in major surgery, shrinking inferior turbinates, electro-coagulation of tonsils, removing hemorrhoids, etc., have attracted considerable attention and are now extensively used.

APPLICATIONS

We will not attempt to describe the technique in detail for every condition that might be encountered. The various methods will be covered and cases selected to illustrate the general procedure.

Growths and blemishes, depending on their nature, size, location and whether or not anesthesia is to be used will be removed by one of three methods:

1. Monopolar Desiccation, for limited superficial destruction, as in small nevi, small pedunculated warts, small patches of leukoplakia, telangiectasis, small papillomata, etc. Power should be set to produce a spark about 1/16 in. long. This is correct for the average case. Less power may be used on very small growths, or where it is desired to work slowly and limit the pain felt by the patient.

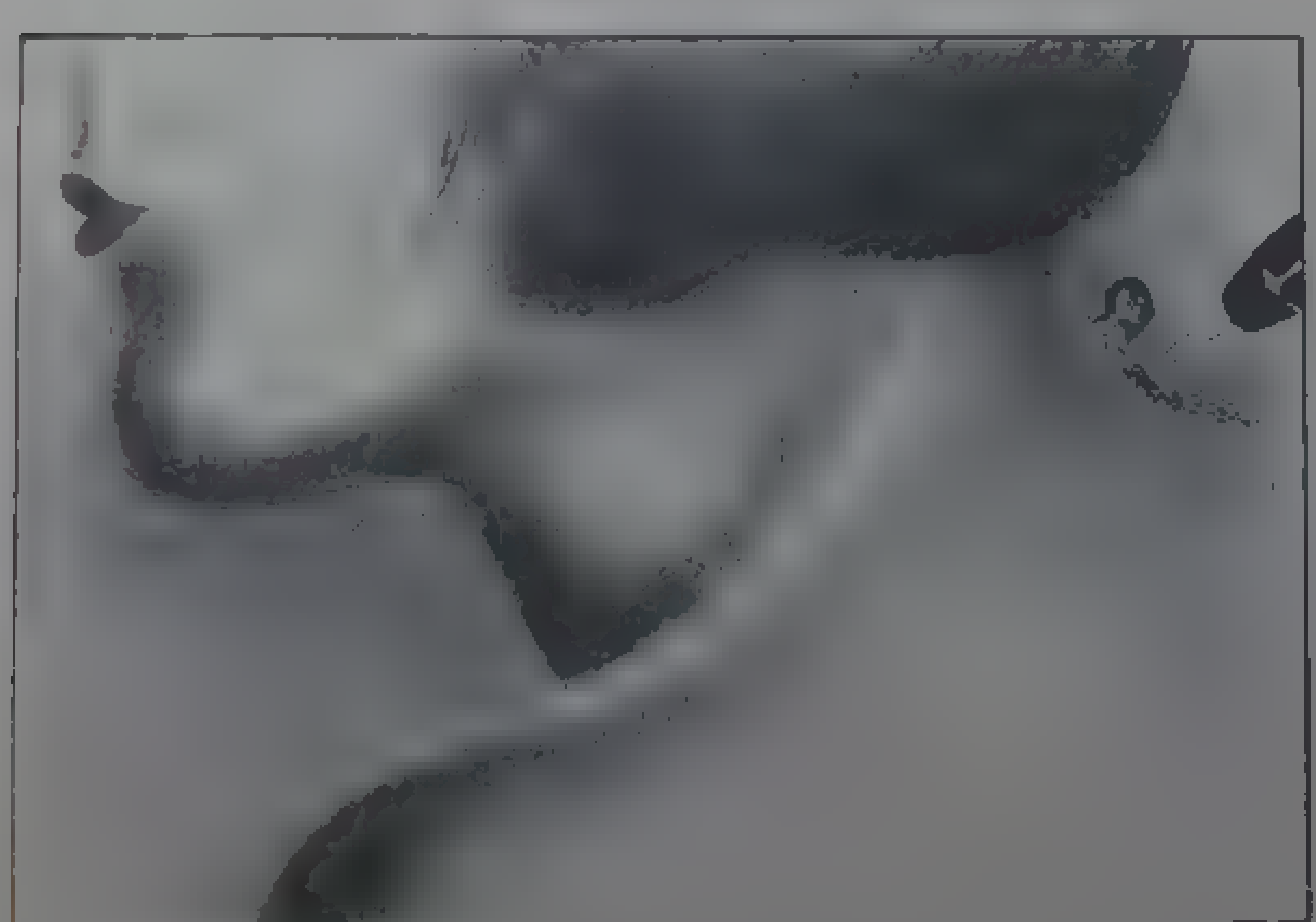
2. Bipolar Coagulation with the active electrode contacted superficially. Useful for destruction of growths of moderate depth but of large area. Power required will vary, depending on the size of the electrode and depth of destruction desired.

3. Deep Bipolar Coagulation with the electrode inserted into the tissue to any required depth; used in destroying massive growths. Power required depends on size of needle, depth inserted and amount of destruction required.

Typical examples of these different methods are illustrated.

EXAMPLE A -- Small purely superficial blemishes such as patches of leukoplakia, telangiectasis or x-ray dermatitis may be destroyed readily by monopolar desiccation without anesthetic. Sparks about 1/16" long are applied intermittently - in very short flashes - until the entire patch has been covered. The blanched and dried out appearance of the surface indicates superficial destruction. The dried - out tissues separate; a scab forms and healthy connective tissue grows below.

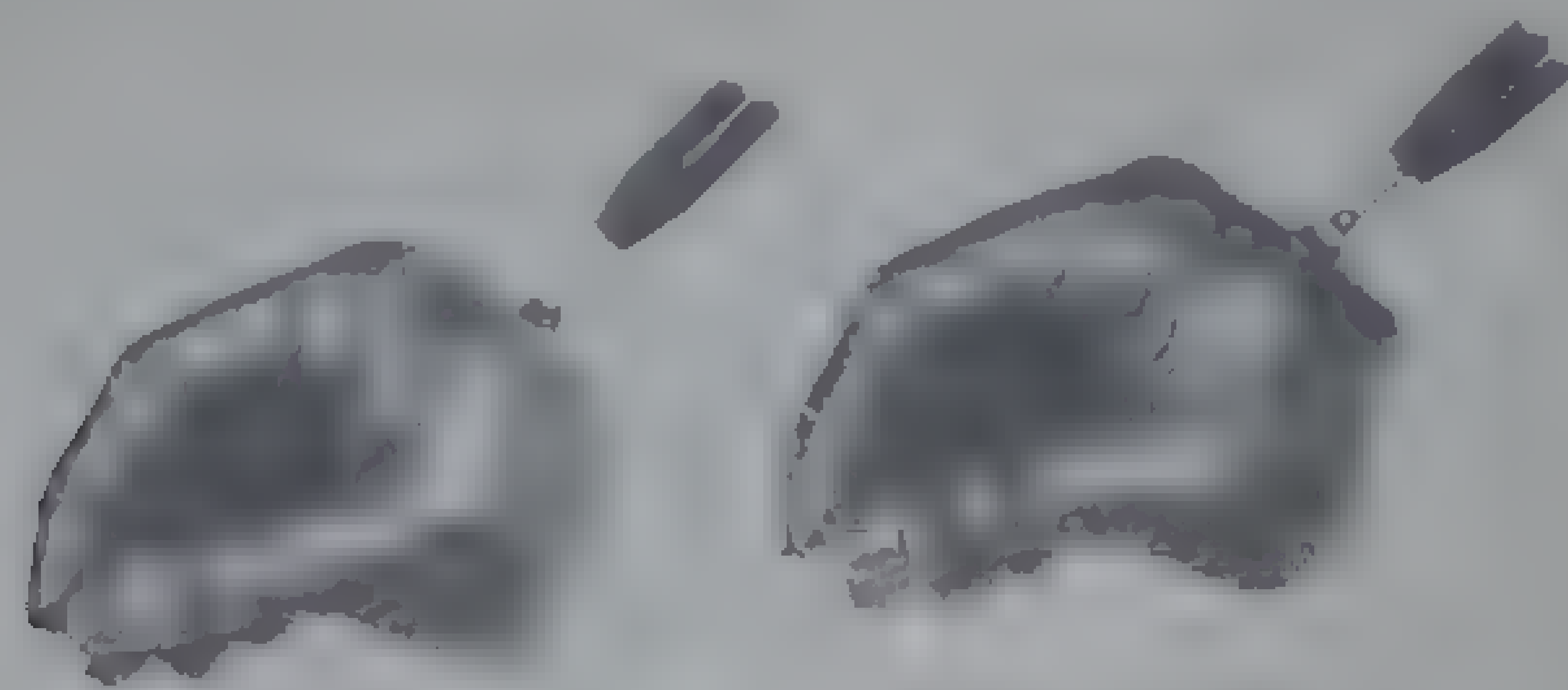
Example A



Example B

EXAMPLE B -- Very small warts or nevi, or even larger growths if they have a small pedicle, can be removed by monopolar desiccation, without an anesthetic. The entire growth can be dried out by intermittent application of the spark. In the case of growths that have a small pedicle, the spark can be played all around the base of the growth and the pedicle thoroughly dried out. The entire growth will subsequently slough away.

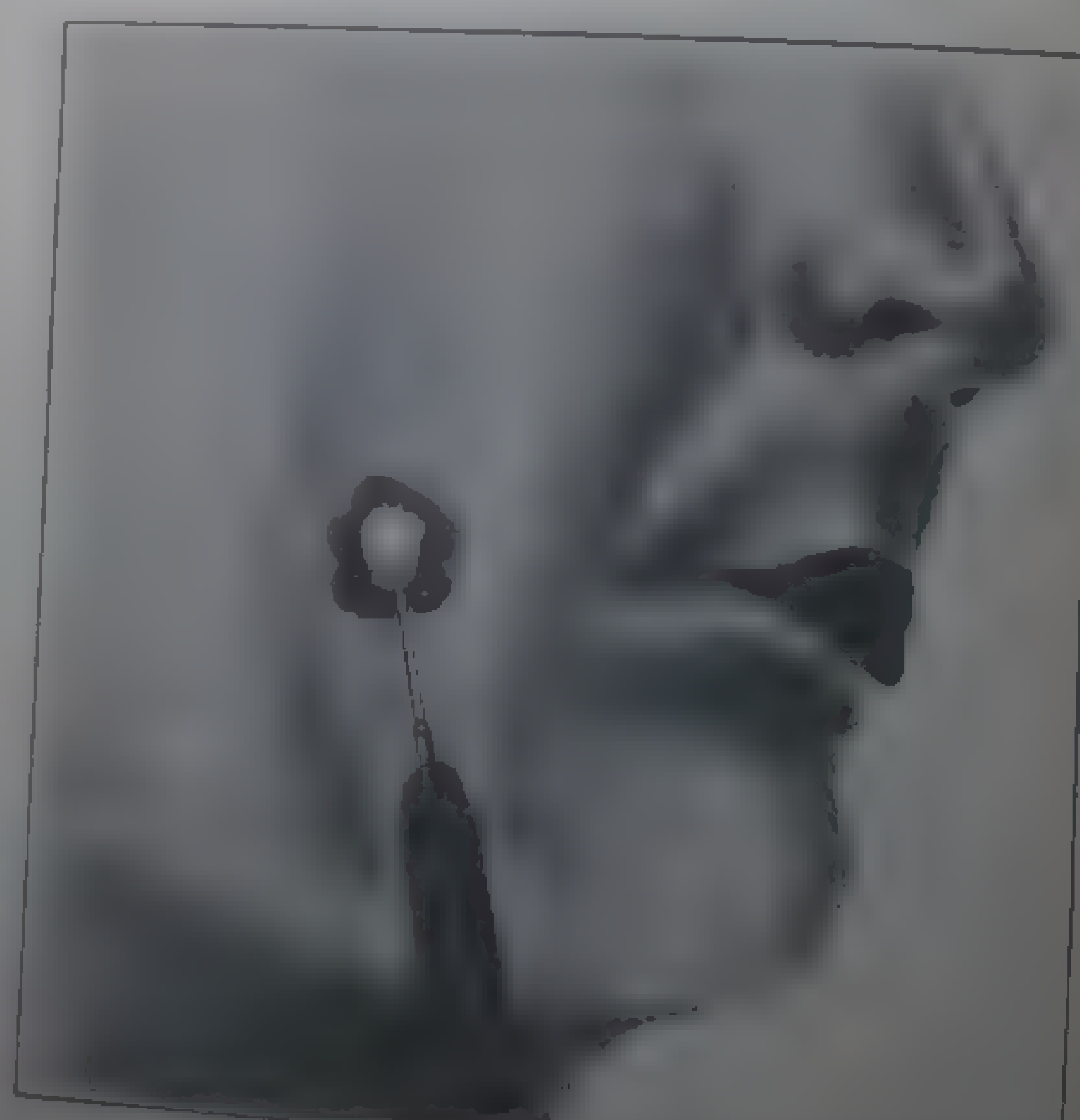
EXAMPLE C - Small growths can also be destroyed by bipolar coagulation by inserting a needle into the growth or by making a superficial contact with it as illustrated.



[illegible] coagulation of small growth [illegible] needle — *Destroying [illegible] growth by contacting tissue with [illegible] electrode*

The disadvantage of this method is that the action of the current is rapid, considerable heat is generated and an anesthetic would ordinarily be necessary.

EXAMPLE D - Larger growths are completely destroyed by successive needle punctures, overlapping areas of the lesion being coagulated until its greyish, dried-out appearance indicates complete destruction. The coagulum may then be allowed to slough - it may be curetted away or looped out with the cutting current. Definite rules can not be given as to whether the mass should be removed or allowed to slough normally. This will depend on the size of the growth, its location, etc. If the coagulum is curetted or removed with the cutting current, it is well to [illegible]y treat the [illegible] wound with the [illegible] so [illegible] dried- [illegible] as [illegible] of [illegible].



The foregoing are merely examples of how the current may be used in dealing with ordinary blemishes and growths. As formerly noted, the exact technique and power setting required for each individual case cannot be predetermined accurately. Only experience and familiarity with the apparatus will enable the operator to correctly preset the power. Meat experiments are helpful in deciding on approximate power settings.

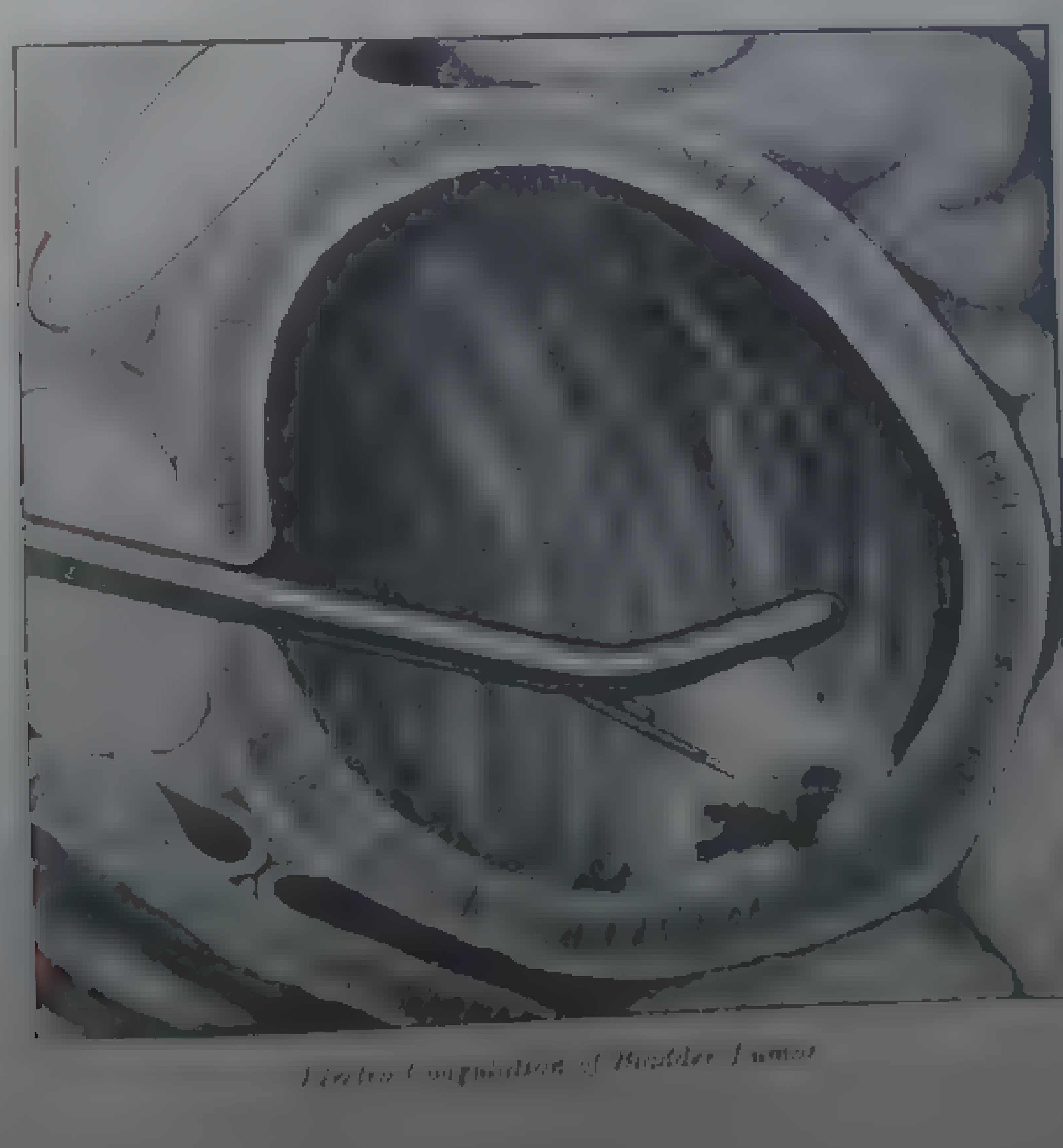
The same general principles apply in removing blemishes and growths in any accessible location.

For example, papillomata, fibromata and other benign growths on the vocal cords may be coagulated and allowed to slough. Perfect results without functional impairment have been secured.

Bladder papillomas are removed through a cystoscope - by desiccation if small - by coagulation in the case of larger growths.

Urethral caruncles, chancroids which resist other forms of treatment, corneal ulcers, tabs of lymphoid tissue and adhesions found around the mouth of the Eustachian Tube may be readily removed. Light desiccation of all red and eroded areas is a highly satisfactory means of treating cervical erosions.

Again, it may be well to repeat that any accessible growth or mass of tissue can be easily and readily removed by these methods.



Electro Coagulation of Bladder Tumor

ELECTRO-HEMOSTASIS

In recent years electro-coagulation has proven extremely valuable as a means of securing hemostasis in major surgery. It is particularly useful in those operations where many small and fair sized bleeders are encountered -- where ordinarily many clips, hemostats or ligatures would be required. For example, in thyroidectomies (1 and 2) applying the coagulation current to the many small bleeding points reduces the number of ligations and effects a considerable saving in time. Bartlett (1) states that operations have been done in which no ligatures whatever were used other than transfixing and ligating the upper poles.

It seems to have an equally useful field in such operations as nephrectomies, hysterectomies, removing fibroid tumors, etc.

In electro-hemostasis, bleeders can be roughly divided into three general classes:--

1st - Very small vessels which usually do not bleed after clamp is removed.

2nd - Small or moderate size vessels, which bleed after taking off clamp and require ligation.

3rd - Larger vessels, which will still require the customary ligation and for which electro-hemostasis is not recommended.

Those of the first class can be sealed for certain by applying a mild current for a very short time -- just a flash. This produces no more than a "pasting shut" action on the ends of vessel, with practically no coagulation or tissue destruction.

A large percentage of bleeder difficulties arise from vessels falling between the 1st and 2nd classifications, vessels which may or may not bleed on removal of clamp, but of which there are too many to justify ligation. This class can be handled admirably and very quickly by a technique half way between that recommended for groups 1 and 2 by simply varying the length of time current is applied, without changing whichever machine setting you may have at the time. If set for class one, give longer time. If set for class 2, leave current on a shorter time than for a class 2 vessel. The exact amount and time is, of course, a matter of individual experience. It is in these [illegible] the group 2 cases that electro-hemostasis affords its greatest advantages.

In sealing group 2 vessels (those smaller than one-sixteenth inch diameter but most decidedly not in class 1),

a small amount of tissue surrounding end of vessel is coagulated along with the end of vessel, creating sort of a plug. The larger the vessel, the larger must be this "plug". Usually the amount of adjacent tissue gripped by the hemostat anyway is just about the right amount needed to form a plug. See details later on describing how current strength, length of time current is applied, and other factors, determine amount of coagulum formed.

In the third group, which includes all vessels larger than class 2, electro-hemostasis is not recommended whenever ligation would perform the function equally well. The number of such vessels is not large enough to effect any material time saving --in fact with large vessels ligation can be done in no more and sometimes less time than electro-hemostasis, and would not involve as much tissue destruction. Likewise, with large vessels, unless an extra large plug of coagulum is created, there is the possibility of post-operative hemorrhage or premature separation or absorption of the coagulum -- contingencies which are quite remote in dealing with class 2 or smaller vessels.

There are some exceptional instances where the use of electro-hemostasis may be justified in class 3 vessels -- especially when other methods would not be safe or satisfactory. Those will be described in detail later on.

Fig. 6 illustrates the method of applying current to clamp. Tip of active electrode is brought into actual metallic contact with suitable portion of the clamp. Then foot switch is depressed until you observe the desired degree of blanching in tissues immediately surrounding end of clamp. Current is then turned off by releasing foot switch. Contact of electrode tip on hemostat is then removed.

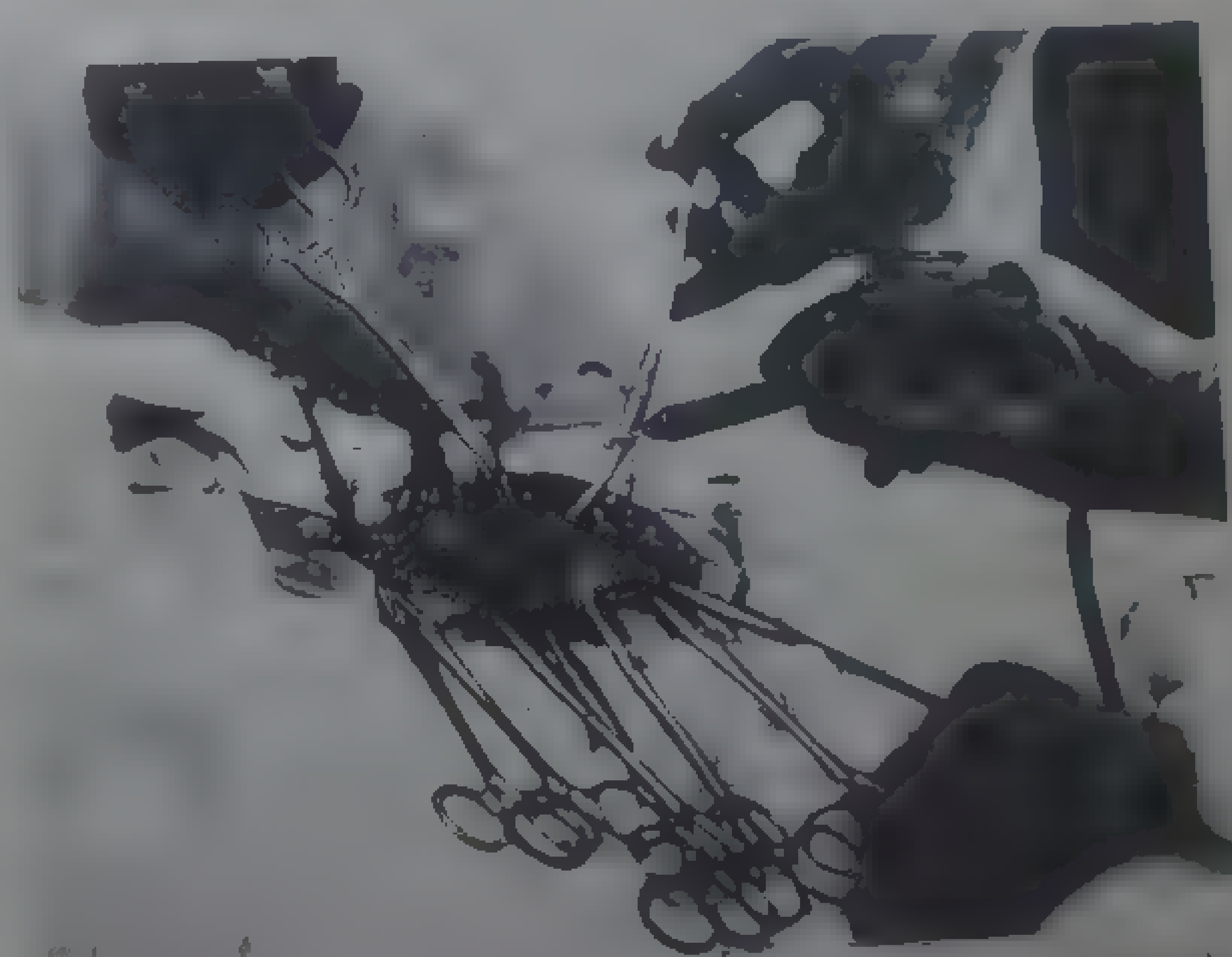


FIG. 6 Showing method of applying electrode momentarily to arrest bleeding point.

One can easily contract the habit of standing on foot switch all the time, or pressing foot switch first, then contacting electrode to clamp, or of keeping foot switch depressed while contact of electrode tip to hemostat is broken.

Any of these procedures will cause a spark to pass whenever contact is made or broken, which is very undesirable. It also may present a needless explosion hazard with some anesthetics.

Clamp to which current is applied must not touch other clamps or any metal objects. This would spread the current, instead of concentrating it at tip of clamp, with result that sealing action would be ineffective.

Clamp should be held up, so that it stands out radialy from tissues, with the vessel under only the slightest amount of traction when dealing with class 1 vessels and only a mild hemostatic action is desired. On anything larger than class 1 vessels, where a small plug of coagulum is to be formed around end of vessel, no traction should be used. Likewise, guard against pushing downward on clamp, into surrounding tissues. This will cause an excessively large plug to form, with needless tissue destruction, or, if current is not left on long enough, would cause an ineffective seal.

Under no circumstances should current be applied to a clamp which is laying loose on its side. For a normal current application this would produce ineffective sealing. If time were increased until blanching is noted, you will also then find more or less coagulation of all other tissues in contact with clamp.

For similar reasons, one should not attempt to seal the end of a vessel, with the vessel itself and probably a portion of the hemostat immersed in a pool of blood or fluid if this procedure can possibly be avoided. Sponge blood or fluids free from the field. Then coagulate before any more blood can seep in.

Occasions may arise where it is impossible or at least very undesirable to clear away all blood or fluids before coagulating or sealing bleeders. In that event, it can still be done, provided it is understood that a dried blood clot will remain along with considerably more than the usual amount of surrounding tissue destruction. To prevent this destruction going any deeper or more extensive in area than necessary, under such circumstances reset the power of machine for a greater amount. Do not attempt to handle such a case by simply increasing the time interval that current is applied, and leaving the power setting the same. That would produce needlessly deep and extensive tissue destruction. Then, after that particular job is completed, be sure and again reset the machine for lower power usually used.

The exact amount of power used, time, etc. in sealing bleeders, varies to some extent with different operators. There is, however, only one power and one time factor for any given size vessel which will give optimum re-

sults. You cannot vary this by using less time and increasing power proportionately and still securing best results. Reasons for this are explained in detail under heading "General Principles".

As one becomes more proficient, there is the temptation to use more power and a shorter time. <u>This is dangerous</u>. Nothing is gained, as the difference in time in the two cases would only be a small fraction of a second.

If the matter of power used is carried to great extremes, it is easily possible to generate so much heat so quickly that a cloud of steam would be formed, which would dilate end of vessel, tending to push its way back into the vessel, or actually burst the end of vessel instead of sealing it. Identically the same result can easily ensue, even with limited current use, if an improper form of current is used for electro-hemostasis. The relatively undamped current used in electrical cutting (when variable dehydration effect is not available) is not at all suited to hemostasis.

COAGULATION OF LARGE BLEEDERS - We have encountered some few instances where in special cases it was vital that a large vessel, or more often a group of large vessels, be sealed by electro-hemostasis rather than using ligation. Such cases are rare, but are met with in some brain surgery and might be encountered in some other fields. In that event, the only recourse is to create an unusually large "plug" of coagulum around end of vessel. This cannot be as well done by the usual procedure. Here it is customary to use a small electrode, and applying this electrode directly to the tissues for some distance beyond and surrounding the point at which vessel is gripped by clamp, until the plug is formed. Then after that, current is applied directly to clamp as in the case of smaller vessels.

It must be remembered, however, that when a wound is closed up, all coagulated tissue must be absorbed if that wound remains closed. Experience shows that rate of absorption of coagulum is about the same as one would expect in a similar mass of catgut ligature material. The coagulum remains in the wound as a foreign body. If an excessively large amount is left in the wound, beyond the ability of the tissues to absorb, sloughing will take place.

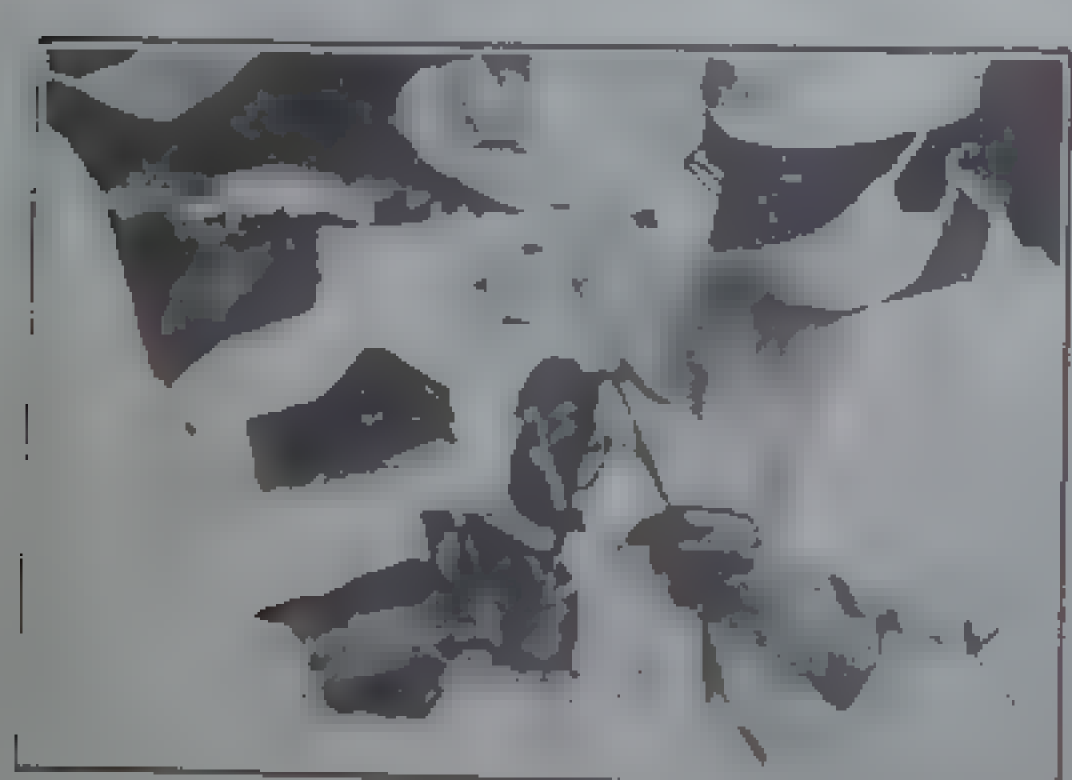
DRYING UP SUPERFICIAL VESSELS -On the surface of the [illegible], and around the stomach, one often meets a considerable [illegible] of vessels which must be sectioned. Dr. Harvey Cushing [illegible] a novel manner of dealing with these in his [illegible], which may be applicable in other regions. A

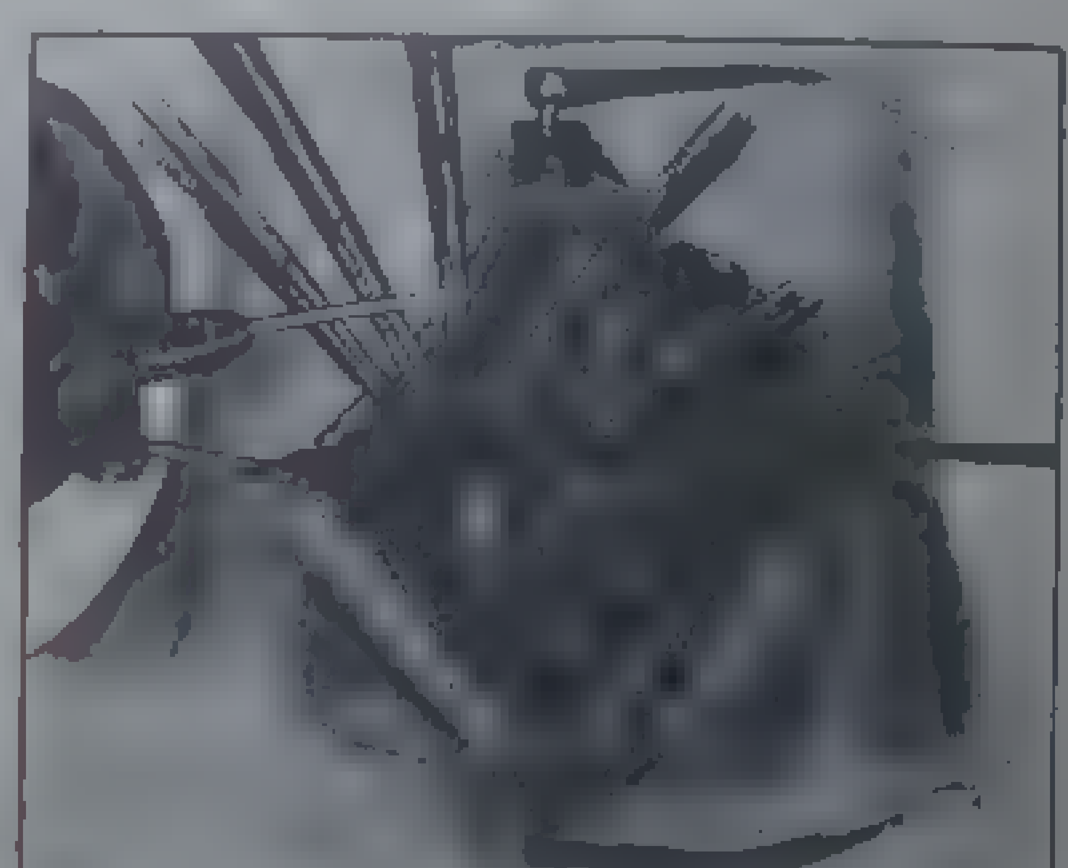
Ball electrode about 1/8" diameter is used in connection with the usual coagulating current of a power depending on size of vessels. Beginning at distal end of vessel, its surface is gently stroked in a series of short strokes, which, if everything is done exactly right, results in "chasing" the blood back into the vessel end, sealing the vessel shut as you proceed.

DESICCATION - Desiccation is the same procedure as electro-coagulation in all respects, except instead of inserting the electrode into the tissues or contacting the tissues, it is continuously brushed over the surface being desiccated with the tip of electrode maintained a small distance (1/16th inch or so) from that surface. This causes a constant shower of fine sparks to spray from end of electrode to tissues. The sparks produce dehydrating or desiccating action and corresponding whitening of the tissues. The effect can be varied from the thinnest amount of dehydration -- a few thousandths of an inch up to one eighth of an inch or more, by varying the intensity and time.

Desiccation is often very valuable in stopping oozing from large areas of very highly vascular tissue.

On account of the sparks taking place when desiccation is used, the utmost caution must be exercised when using ether anesthesia. It positively must never be used in the presence of ethylene or any other violently explosive gas.





A DESICCATING SPARK

THE ANESTHETIC

The use of electro-surgery imposes some limitations on the anesthetics that can be used. It is to be remembered that you are working in the presence of electrical sparks which could ignite or cause explosion of anesthetics having these characteristics. The choice of anesthesia should be made with this fact clearly in mind.

Electro-Surgery should never be used with ethylene, as only small concentrations of this gas can produce violent explosions in the presence of even the tiniest electrical spark.

In the past it has been the custom to discourage the use of ether anesthesia in connection with electro-surgery. However, many electro-surgical operations have now been performed under ether without serious accidents and in the light of experience to date, we believe that ether is reasonably safe if the work is carefully done and every possible precaution against ignition is taken. These precautions should include separation of the operating field from the anesthetist by means of drapes, continuous ventilation of operating room, spillage avoided, immediate removal of empty ether cans, etc.

It should also be remembered that ether administered by the open drop method is more likely to ignite than when it is administered through a mask. Also, ether should never be used when there is any communication between the operating field and the respiratory passages.

Of the inhalent anesthetics it may be said that nitrous oxide and chloroform are quite safe. Ether is reasonably safe if carefully used, and ethylene is absolutely interdicted.

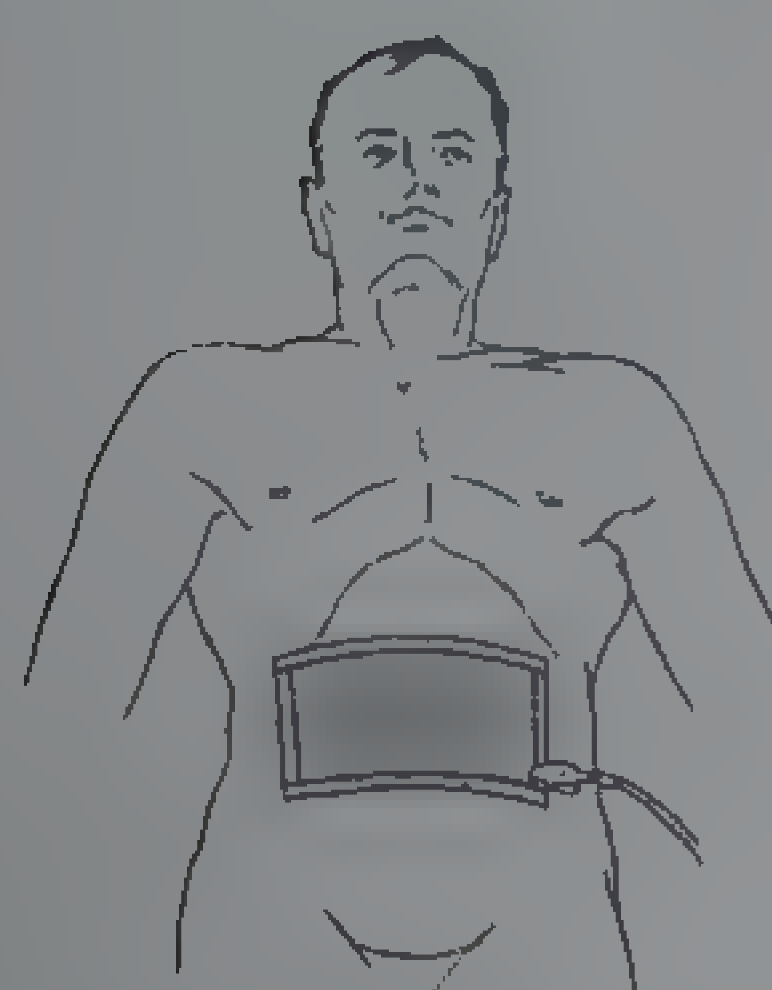
For light work on the mucous membranes, the topical application of such anesthetics as novocain, nupercaine, butyn, etc. are usually sufficient.

Where a purely local anesthetic is used in connection with electro-surgery, it is best to avoid injection directly into the operating field. Neither the cutting or coagulation currents can be used to best advantage in tissue infiltrated with large quantities of fluid. The anesthetic should be injected around or under the operating field or the nerve block principle used.

Other than above mentioned, there are, so far as we know, no objections to any of the anesthetics ordinarily used.

With the present-day techniques of administering spinal, transsacral, caudal, avertin, twilight sleep, etc. the surgeon has a wide choice from which a selection can be made that will prove safe and satisfactory for use with electrosurgical methods.

THE INDIFFERENT ELECTRODE



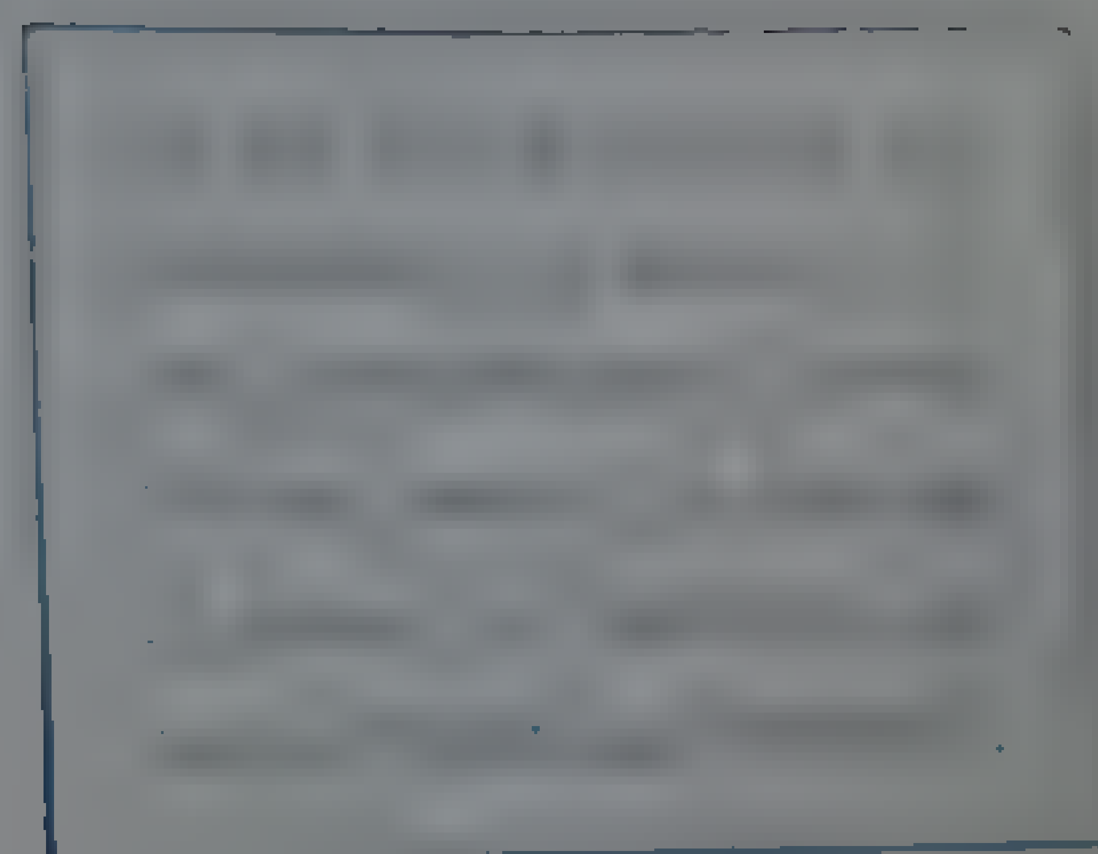
The indifferent electrode may be held firmly in place by using a sand bag or an elastic bandage

The indifferent electrode consists of a plate of diathermy metal which is applied to some convenient part of the body as close to the operating field as possible. For example, it may be applied under the buttocks or shoulders, to the back of the neck, to the abdomen, the patient may sit on it or it may be bandaged to an arm or leg.

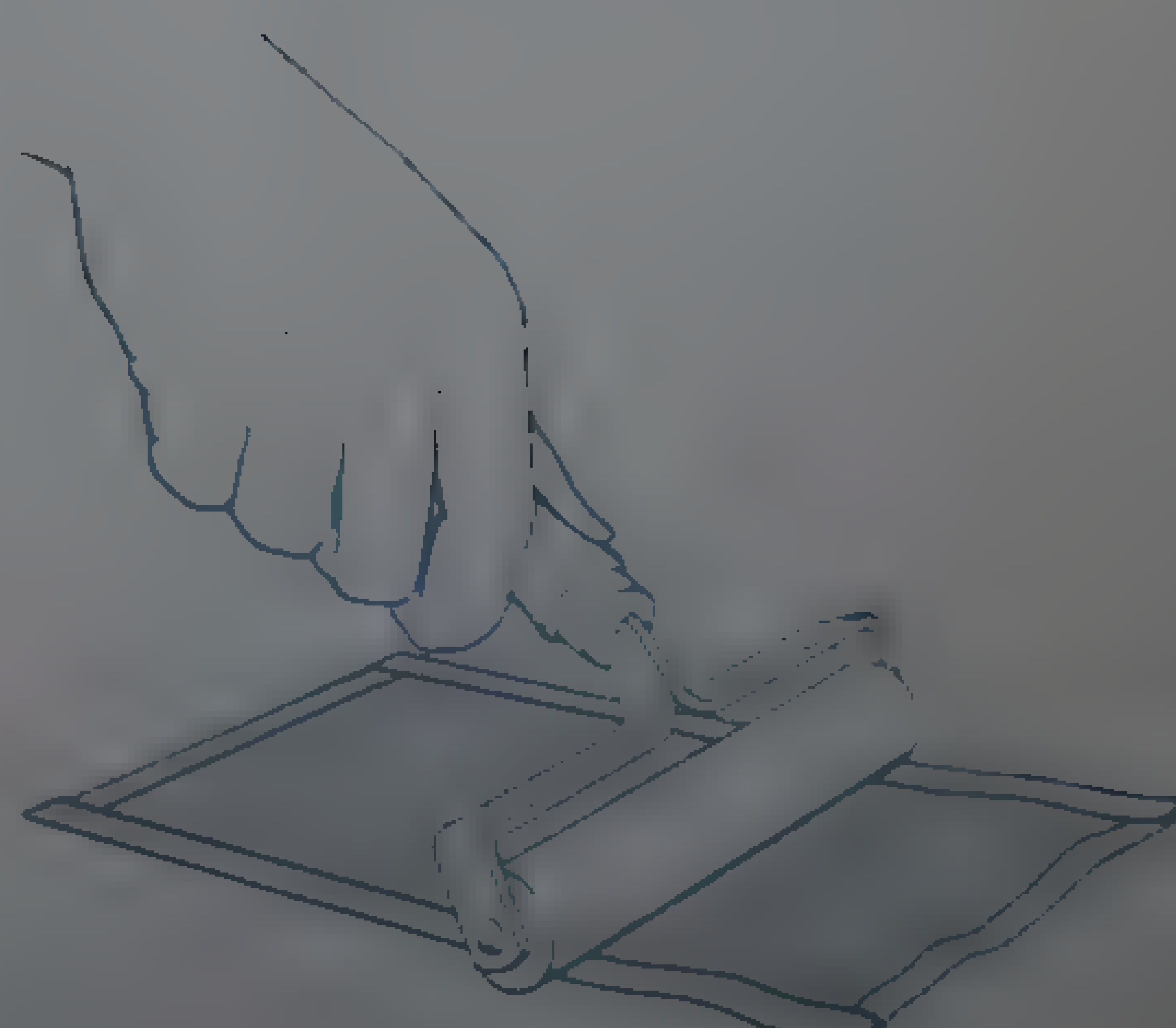
It should be firmly held in place either by an elastic bandage, sand bag, or by having the patient rest his shoulders or buttocks on it.

The size of the indifferent electrode may be varied within certain limits, but for all major electrosurgery a fairly large plate should be used, say 10" x 12". For light work where the electrode is bandaged to an arm or applied to the back of the neck a small plate, say $2\frac{1}{2}$" x 6" will serve.

Apply indifferent electrode close to operating field. Illustration shows pressure of body holding it firmly in place



It should be rolled perfectly flat with the roller each time before using. If these precautions are observed, it will avoid sharp points or irregularities in the plate which might dig into the skin, causing a concentration of current with the possibility of burning at that point.



The Indifferent Electrode

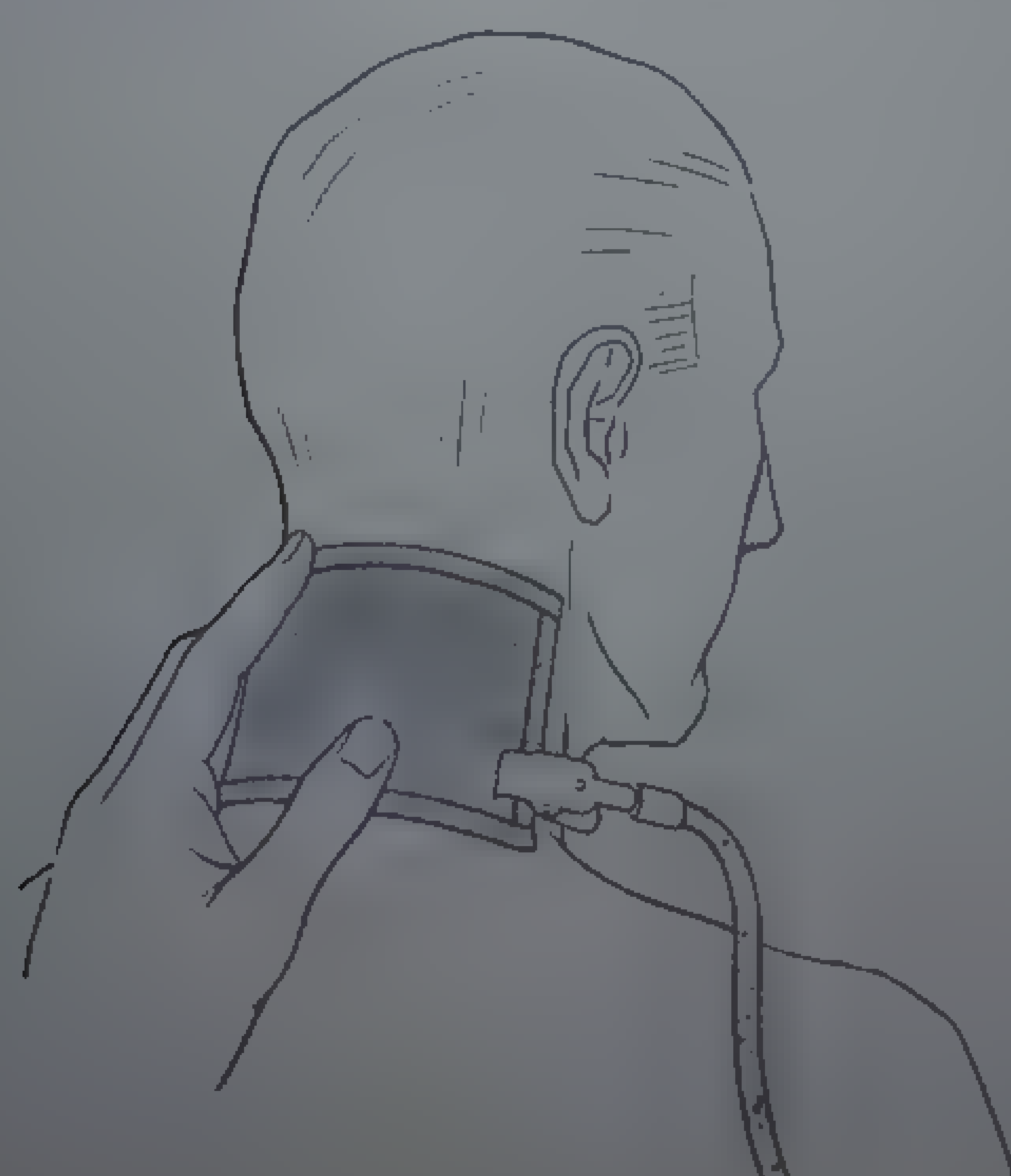
The patient's skin should be thoroughly moistened with [illegible] immediately before the electrode is applied. Under no circumstances should vaseline, oil or greasy substances be applied to the [illegible]. Mineral oils and greases are [illegible] and if used, would cause a poor contact with likelihood of a burn.

The clip on the connecting cord should be protected by a rubber guard or a pad of gauze so that the patient's skin does not press on the clip and cause a burn.

Ordinarily, if the surface is thoroughly moistened, a slight growth of hair does not interfere with the electrode making contact. however, the electrode should never be applied over a heavy growth of hair or over any extensive area of hard, dry scar tissue.

Poor or uneven electrical contact at the indifferent electrode can cause a skin burn. Poor contacts may be caused by heavy hair, hard dry scar tissue,a wavy electrode that contacts only in spots,failure to moisten the patient's skin,etc. Sharp points that dig into the skin cause a current concentration at that point with a very good chance of a burn occurring.

OBSERVATIONS OF THE ABOVE PRECAUTIONS WILL PREVENT BURNS AT THE INDIFFERENT ELECTRODES.



PRELIMINARY EXPERIMENTAL WORK

—CUTTING—

The use of electrical cutting currents is quite different from surgery with the conventional scalpel. The operator must accustom himself to the extra manipulation of turning the current on and off with the foot switch, and must learn to synchronize this with the use of the operating electrode. He must become accustomed to the "feel" of the cutting electrode, or rather the lack of "feel", for the electrode cuts without that useful feeling of resistance that a scalpel gives. He must become accustomed to the relation between the depth of incision, speed of cutting and the power setting on the machine. In order to learn what results can be secured under different conditions, it is advisable to do some experimenting on a piece of meat before using the machine on actual cases.

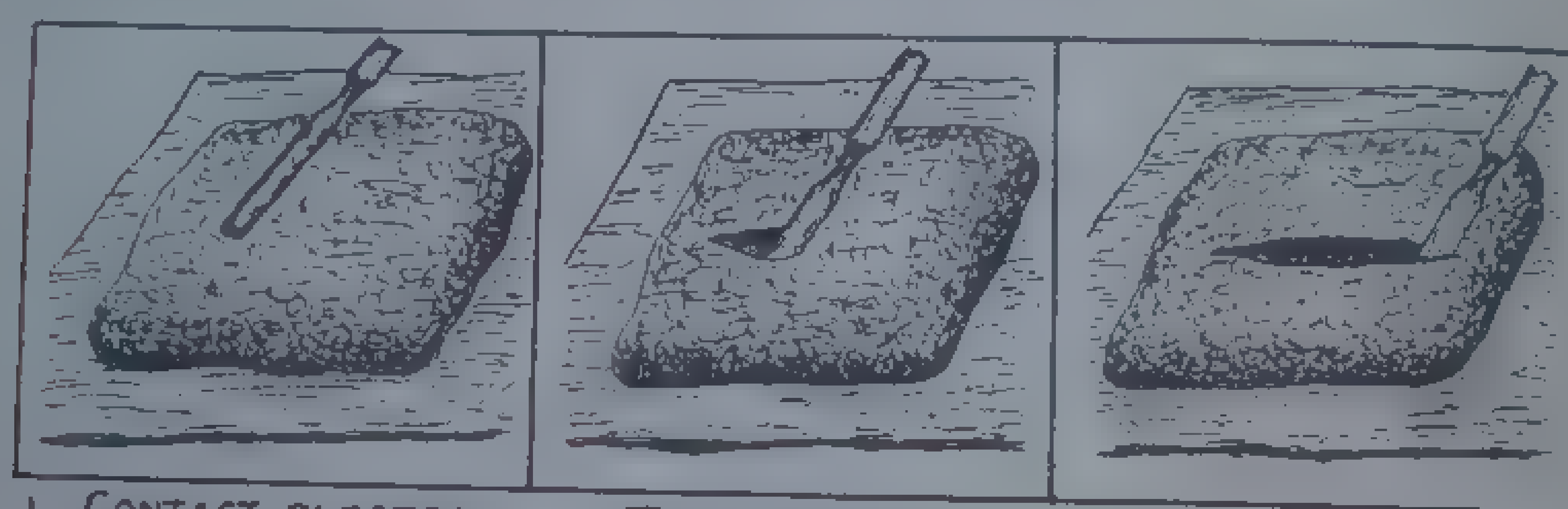
A good sized piece of veal, or a heart, answers the purpose best. Beef has too coarse a grain to compare properly with human tissues. Secure a piece of meat that has some fat, some cartilage, and some fascia on it in order to see exactly how the cutting current performs on these different structures. If it is dried out, before using, it is well to moisten the meat so as to get its moisture content about the same as that of live tissue. If desired, a moderate amount of slightly saline water can be injected into the meat with a hypo syringe. Tissues with a normal moisture content are somewhat harder to sever neatly than the more dry tissue in dead meat, and we are aiming to have as close an approximation to actual conditions as possible.

After the meat tests are completed it is further advisable, when conditions permit, to either see work being done on actual cases by an experienced operator, or to carry out further tests yourself on animals. Work on dead meat, even though it has been moistened, is not entirely comparable with work on live tissues, as in the latter you have a higher temperature, a greater amount of moisture, as well as the blood stream, to alter the conditions.

Lay the piece of meat directly on a plate of diathermy metal which acts as the indifferent electrode. Connect this plate to the "Patient" terminal on machine. If the edge of the metal is bent over for a distance of about one-eighth of an inch and then pressed flat this will hold the clip in place and keep it from pulling off the edge. Connect electrode handle to the active terminal. Use about one third of

total power. Select one of the flat cutting electrodes, say the smaller of the two sizes, and insert in handle. You will notice that the edge of the cutting electrode is not sharpened enough to cut of its own accord.

Now place edge of cutting electrode lightly in contact with some of the muscle tissues on the meat, simultaneously turn on current with foot switch and lightly draw the electrode through the meat at about the same rate of speed as you would if cutting with a scalpel. You will notice (if you have the machine properly adjusted) that the electrode passes through the tissues with practically no resistance. The current should be turned off at just exactly the same instant that the electrode emerges from the tissues at the end of the cut.



1. CONTACT ELECTRODE BEFORE CURRENT IS TURNED ON.
2. TURN ON CURRENT & SIMULTANEOUSLY START MOVING ELECTRODE.
3. TURN CURRENT OFF BEFORE ELECTRODE IS WITHDRAWN.

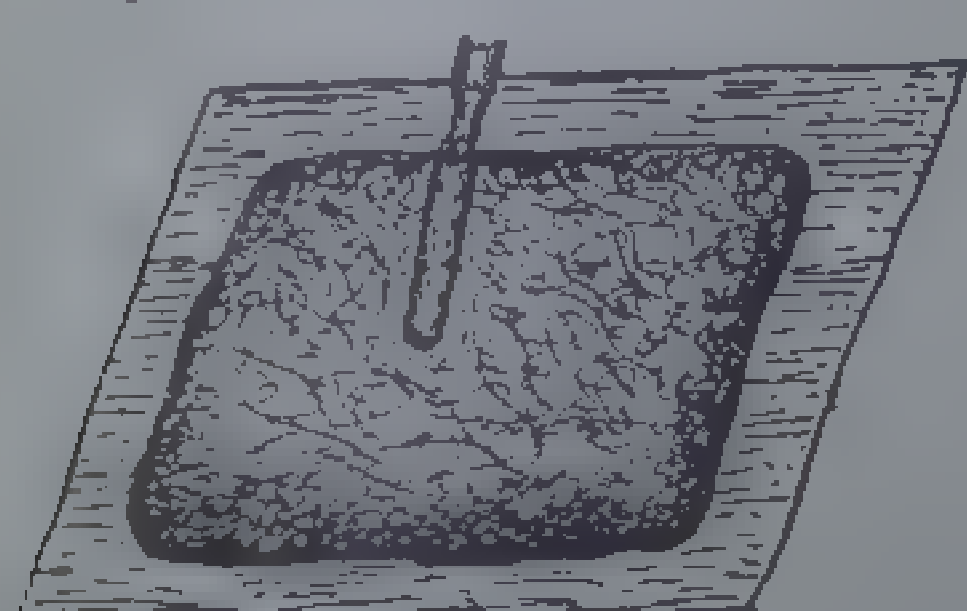
If the current is left on too long, there will be a small arc drawn out from the end of the electrode as it leaves the tissue, which is preferably to be avoided. To secure best results, the operator should become accustomed to proper synchronizing, i.e., turning <u>on</u> the current with the beginning of the incision and turning <u>off</u> the current exactly at the end of the cut.

If the current is thrown on before the operator is ready to move the cutting blade through the tissues, a flash will take place before he begins moving the electrode and there will be a wider depth of dehydration at the start of the incision. Usually this will not hurt but it is best to learn how to make a perfect job in the beginning. Now replace the small blade in the electrode handle with one of the larger ones.

Try the same thing over but this time set your power control at about two thirds of the total and if you have enough thickness of meat you can make an incision of an inch or more in depth. Avoid [illegible] electrode [illegible] meat so that it strikes the indifferent plate [illegible] a short circuit will form, [illegible] electrode.

Now try the following: Hold the flat side of the cutting electrode in contact with the meat throughout most of the area of the electrode. You will note it no longer cuts, but rather burns and cooks the tissue. Then reduce the power down to say one third to one half the total and slightly press the entire length of the cutting edge of the cutting electrode against a fresh portion of the meat. You will note that it again either fails to cut entirely and simply burns or cooks the tissue, or else that there will be a time interval at the start when it first cooks the tissues and thereafter begins to cut -- only after an appreciable width of tissue has been cooked and thereby dehydrated and presenting a lower resistance, so that the electrode can begin to cut. These experiments are suggested in order for you to visualize a very important feature in connection with the manipulation of the electrode. Many surgeons are accustomed when using an ordinary scalpel to lay the entire cutting edge of the scalpel directly on the tissue and then press down and draw the scalpel across.

If this is done with the electric scalpel you will obtain results on actual cases just as previously demonstrated on the piece of meat, that is, it will only begin to cut with difficulty or might not cut at all, and will cause extensive coagulation of tissue throughout the full length of contact.



START YOUR CUT LIKE THIS WITH ONLY TIP OF ELECTRODE IN CONTACT WITH TISSUE.

NOT LIKE THIS WITH ENTIRE EDGE IN CONTACT.

You should learn, therefore, to start your incision
with only the tip of electrode in contact with the tissues,
and be ready to start drawing it through the tissues as soon
as you throw on the current. Learn to synchronize the move-
ment of the cutting electrode with the turning on of the cur-
rent. This feature of synchronizing the turning on and off of
the current and of properly applying only a portion of the
cutting blade at the beginning of the incision will probably
be the hardest thing to become accustomed to, but after a few
trials it will come natural to do this and will present no
difficulty whatever when you are once accustomed to it.

Now repeat the above experiments but use a needle type electrode instead of the blade. You will notice that, with the

needle electrode there is not nearly so much precaution necessary in the way you apply the electrode to the tissues at the beginning of the incision for there is a natural tendency to contact the point only. The needle electrode, however, for the same power setting gives a somewhat <u>greater depth of dehydration</u> and does not pass through the tissues quite as readily as the thin flat blade. Nevertheless, you will find the use of the needle electrode advantageous where you want to secure quite heavy dehydration on the edges of the wound.

Both the flat electrode and the needle type electrodes have their temper drawn just enough so that they can be formed to any desired shape between the fingers. This will prove an advantage where it is desired to scoop out small sections of tissue.

Now try one of the flat cutting electrodes on some cartilage and you will note how readily it passes through if you do not try to force the blade or take too deep a cut for the amount of power used. Try this again with the needle type electrode on cartilage and you will note the flat blade cuts quite a good deal better than the needle on this particular type of structure.

Now select an area of tissue with a small amount of fatty tissue incorporated with it. If the tissue is not too fatty you will notice the cutting electrode severs it nicely. Now select a considerable thickness of fat and try to make a deep cut through it. You will notice it either does not go through or if it does so at all, there is considerable "boiling out" of the fatty tissue or a carbonization of the fatty tissue,which would prove very objectionable on an actual case as it would lead to a degeneration of the fatty tissue, and considerable difficulty in healing would be experienced. The best way of cutting through heavy fat is to use a moderate amount of power -- make several very shallow cuts, an eighth of an inch or less deep -- make the incisions very rapidly - allow a short time interval between each incision -- maintain traction on the wound edges. This will keep heating of the fatty tissue at a minimum and will prevent undesirable "boiling out".

If the piece of meat has some fascia on it,try stripping off the fascia without involvement of too much of the underlying tissue. For this the small flat blade works best and it should be done with a low amount of power. Make thin cuts of from one-sixteenth to one-eighth inch or so in depth.

Next, using a loop [illegible] by "scalloping" [illegible] tissue of va- [illegible]. Using a medium [illegible] about half [illegible] power, you will [illegible] scoop out bits [illegible] of any desired [illegible] it is impor- [illegible] do not place [illegible] of the loop in [illegible] with the tissue be- [illegible] on the cur- [illegible] contact a small [illegible] of the loop light- [illegible] on the current and [illegible] drawing elec- [illegible] the tissue, [illegible] it in to the desired depth after cutting starts. If [illegible] the loop is contacted with the tissue before the [illegible] is turned on, it will start to coagulate and then will [illegible] cut at all or will cut very slowly at first.

[illegible] will note that the loops require considerable pow- [illegible], also that there is considerable dehydration [illegible]. This is due to the loops being made of rel- [illegible], and the fact that even a small section, [illegible] is equivalent to an incision of considerable [illegible] of the loop in contact with the tissue.

[illegible] your meat experiments, using different elec- [illegible] power settings* until you feel that you [illegible] will be secured under various conditions [illegible], and until you have mastered the synchronous [illegible] foot switch and the operating electrode -- [illegible] "foot-switch-minded" -- and until you are [illegible] accustomed to the "feel" of operating with the va- [illegible].

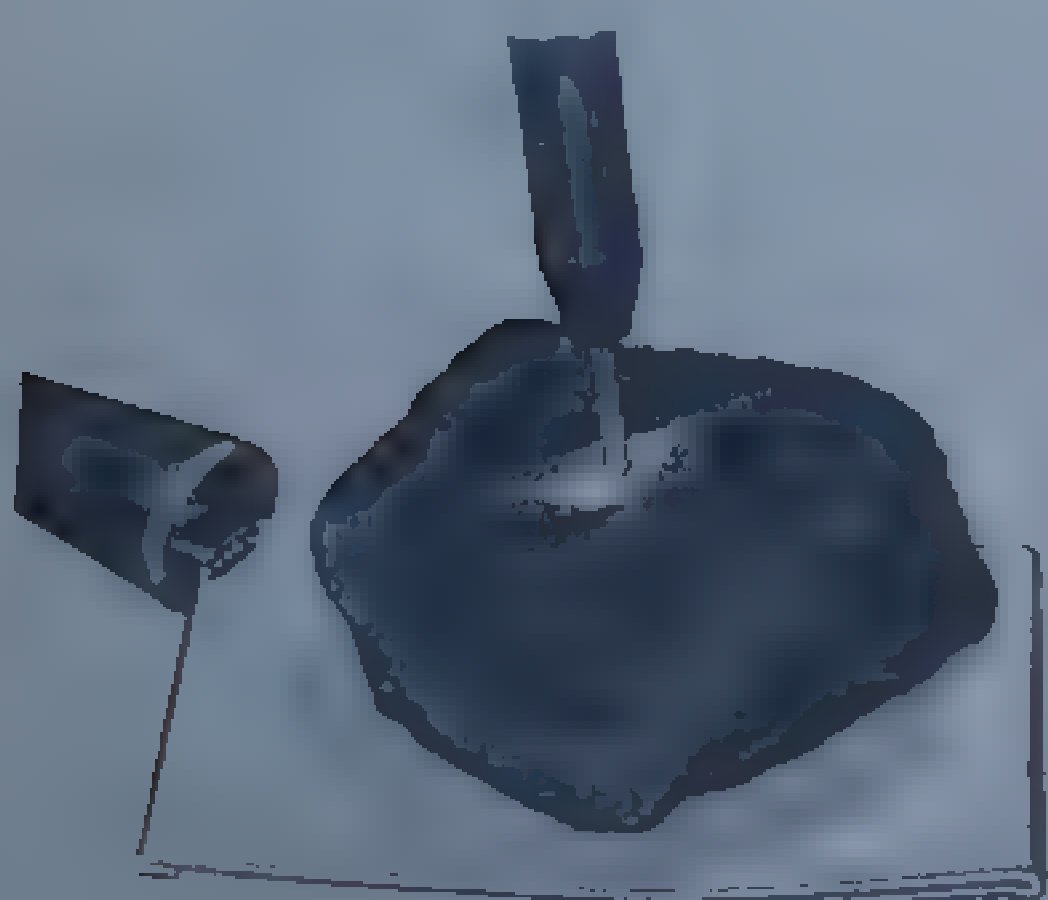
[illegible] lowing these preliminary meat experiments it is [illegible] continue your experiments on live an- [illegible] should be done before any major operative [illegible] power setting, dehydration effect, [illegible], in working on live tissue you are [illegible] actual problem of hemostasis--the effects [illegible] are modified by the blood stream -- the work [illegible] and smoothly as it does on dead [illegible].

[illegible] machine is equipped with [illegible] dehydration, experiment [illegible] different settings, [illegible] meat with a scalpel [illegible] varying depths [illegible].

EXPERIMENTAL COAGULATION

Use the same test piece of meat for experimenting with the coagulation and desiccation current. As previously pointed out, there are too many variables to permit any simple set of rules for power settings and for those unfamiliar with electro-coagulation and desiccation these will need be worked out experimentally as outlined in the following.

For the first test the large, straight, stainless steel needle should be used. Use a fairly heavy power setting, say about half the total. Plunge the needle into the meat to a depth of about a half inch. Then turn on the current until a slight ring of blanched tissue appears on the surface of the meat surrounding the needle. With this power setting, this will take place in probably two or three seconds, Do not allow the current to remain on until pronounced sparking takes place at the active electrode. This is undesirable.



Turn off current and withdraw the needle. Cut a section through the coagulated part and examine the tissue changes that have taken place around the needle puncture. You will find a moderately extensive mass of coagulum surrounding and extending beyond the depth of needle insertion as illustrated above. The line of demarcation between the coagulum and unaffected tissue will be well defined.

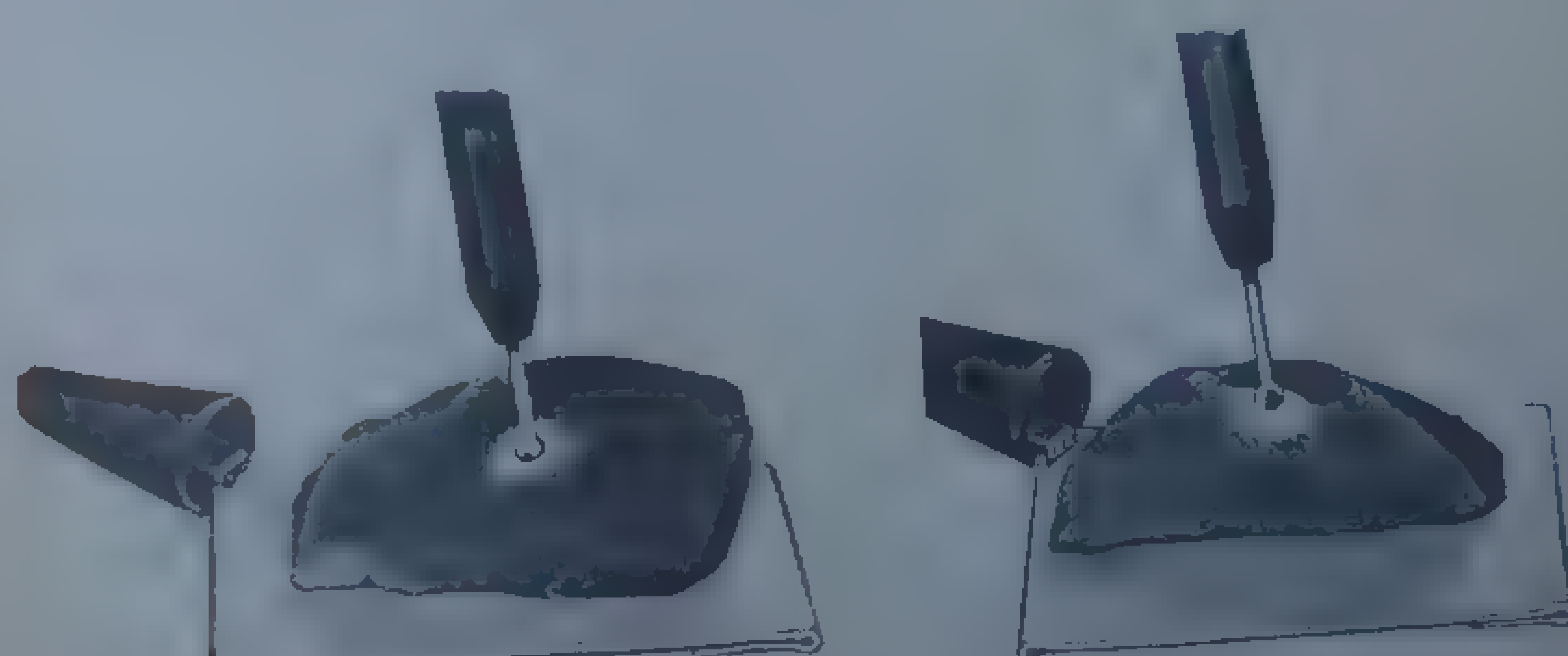
Next try applying a small amount of current for a fairly long time. Reset to a low power, say one fifth to one fourth the total. Again plunge the needle in to the same depth, turn on the current and apply it until you see the ring of blanched [illegible] around the needle. This will require considerable time, [illegible] from forty to sixty seconds with this low power. Sec- [illegible] meat and examine the result.

In this case, you will find a much more extensive mass of coagulum, extending farther away from the needle on the surface and penetrating to a considerably greater depth in the meat, as illustrated on page 19. You will also find that the line of demarcation between the coagulum and the unaffected tissues is less distinct.

From the foregoing it is apparent that there are two possible means of destroying extensive masses of tissue; first, by applying a fairly heavy power for a short time and inserting the needle several times, close together, or; second, using a low amount of power applied for a considerable length of time, which will require fewer needle punctures, farther apart. Of the two the first is probably the better choice, as the depth of destruction beyond the needle point is less, you can more accurately control the amount of coagulum created, and the time element is smaller.

The power settings to use on actual cases can only be determined definitely by trial. As a rule, somewhat more power is required for working on live tissue than on meat.

Insert different sizes of needles to various depths, varying the amount of power and noting the time required to produce the ring of blanched tissue around the needle. With these experiments, and careful examination of the sections, you will soon arrive at a very good idea of the amount of coagulum produced by various amounts of power at different depths of needle insertions, in different periods of time.

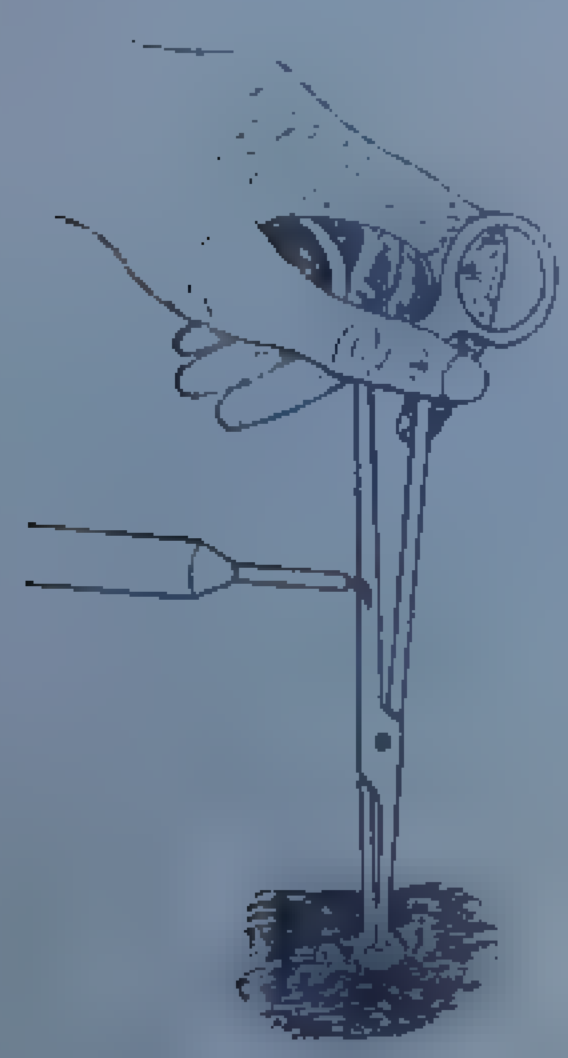


For purely superficial destruction try brushing a ball electrode over the surface of the meat several times until a [illegible] large area is covered and dried out, as evidenced by [illegible]ing. Section and note depth of penetration. Try varying

the amount of power and speed of moving the ball. Note how penetration may be varied from a very thin superficial destruction, a few thousandths of an inch, to any depth that would ever be required for actual work.

Try destroying extremely small particles of tissue. Hook a curved electrode into a small tab of meat. With a very low power setting, turn on the current in short flashes until the entire tab is dried out and blanched.

Then try desiccation, allowing a stream of sparks to play from the end of the electrode onto the meat without making an actual contact. This will dry out the superficial layers of tissue. The depth of destruction can be varied, from a few thousandths of an inch up to one eighth inch or more depending on the power used and the time it is applied.



Next experiment with electro-hemostasis by the "Clamp and Coagulate" method.

Use a medium power setting. Grasp a small bit of tissue with a pair of forceps, touch the active electrode to the handle of the forceps, and turn on the current for a flash or two. If current is left on long enough there will be a blanching of the tissues in a small zone around the tip of the forceps and it is this small "plug" of coagulum which, in an actual operation, seals off bleeding points. Try using different sized forceps and picking up different amounts of tissue. If only a small bit of tissue is picked up it will be blanched by the current in a very short time - not over a second or two. The more tissue picked up, the longer time is required with a given power setting to create the "plug" of coagulum.

Be very careful not to leave current on too long as this will cause undesirable sparking and carbonizing of the tissues and, in an actual operation, if current is left on too long or if too much power is used, steam may be caused in the blood vessel, again rupturing it instead of sealing it off.

In using this technique for sealing bleeders the operator need not be concerned about the current passing up the forceps and into the operator, as with the indifferent electrode connected a direct path is provided for the current and it will travel down the forceps, through the tissue to the indifferent electrode rather than the other way around.

CONCLUSION

That electro-surgery occupies a place of definite value in present-day surgical procedures can not be controverted. Its utility has been thoroughly demonstrated.

In such fields as the removal of intra-cranial tumors, transurethral prostatic resection and intra-pleural pneumolysis it has opened many new and startling surgical possibilities.

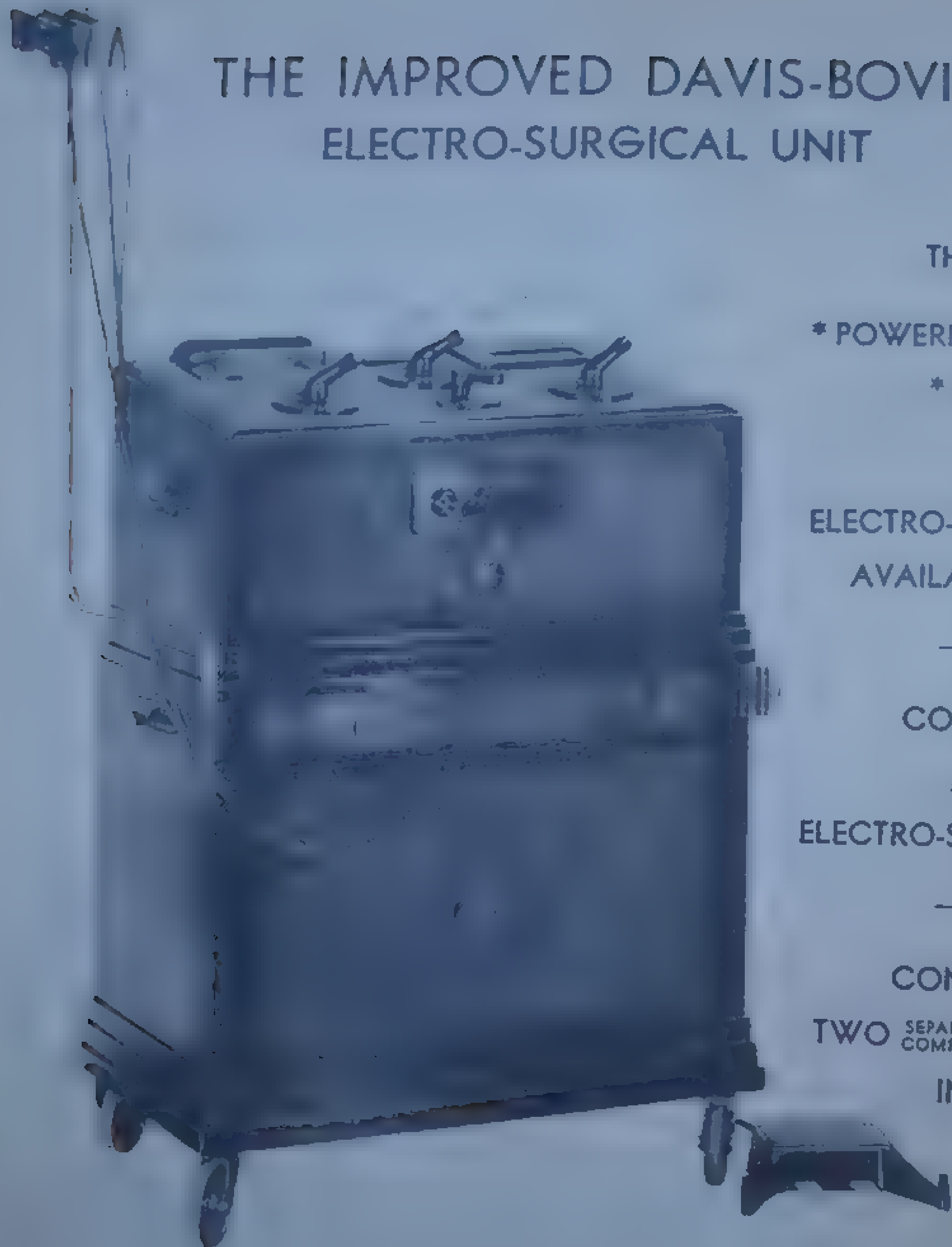
The results secured in the surgery of neoplastic lesions, in breast amputations, cervical conization and thoracoplasties seemingly justify its wide adoption in these operations.

What the future will develop can not be foretold, but one may anticipate better methods of attacking deep-lying lesions as in the rectum, bronchus, etc. No doubt, as the pioneers continue their work many new and novel procedures will appear.

On our part, we will continue to design and manufacture equipment that will serve the surgeon adequately -- completely -- unfailingly.

The high standards of design, construction and performance established by the Original Bovie are maintained in the three current models described in the following pages.

THE IMPROVED DAVIS-BOVIE
ELECTRO-SURGICAL UNIT



THE MOST

* POWERFUL
* FLEXIBLE
* COMPLETE

ELECTRO-SURGICAL UNIT
AVAILABLE TODAY!

COVERS THE
ENTIRE
ELECTRO-SURGICAL FIELD

CONSISTS OF
TWO SEPARATE COMPLETE MACHINES
IN ONE

Left half of unit generates a powerful cutting current - right half generates coagulation current. Both are simply and instantly controlled through means of a double-treadle foot switch.

A feature of this unit is the control of the cutting current hemostasis. Five different types of cutting current are delivered, each with different characteristics and exerting different degrees of hemostasis (dehydration) on the severed tissue. For each condition, and type of tissue, there is a best cutting current. This, in the Davis-Bovie, can be accurately controlled throughout its full range, from maximum down to the minute currents needed in treating detachments of the retina.

In addition to this, the regular coagulation current is available and is thoroughly effective in the control of hemorrhage from all sources.

With all its power, range and flexibility, the improved Davis-Bovie is quite simple to operate. It provides, in a single machine, every known electro-surgical need and all these factors combine to make it the finest electro-surgical unit money can buy. Ask for complete literature.

INTERMEDIATE BOVIE ELECTRO-SURGICAL UNIT

Intermediate in Size
Intermediate in Completeness
Intermediate in Price

A powerful, precisely controlled and thoroughly adequate machine for ALL types of electro-surgery. Incorporates the fundamental principles and features of design which have made Bovie Units the standard of electro-surgery the world over. Except for the larger, more costly Improved Davis-Bovie, this new Intermediate Bovie has no equal in performance, precision and reliability. It can be depended upon for the electro-surgical excellence expected from apparatus bearing the Bovie name.

RECOMMENDED FOR ALL ELECTRO-SURGERY

An ideal machine for surgeons who want a semi-portable unit for combined office and hospital use . . . or for the hospital where a limited budget makes impossible the installation of a larger Davis-Bovie.

A SOUND INVESTMENT FOR HOSPITAL OR CLINIC

The preference accorded Bovie Units by leading hospitals and surgeons for many years is your assurance of complete satisfaction from this machine. If you have waited for a powerful, dependable and medium-priced Bovie . . .

SEND TODAY FOR LITERATURE

NO OBLIGATION

New Intermediate Bovie in all-steel cabinet finished in chip-resisting, easily cleaned, baked-on Ivory Enamel with Chrome trim.

PORTABLE BOVIE ELECTRO-SURGICAL UNIT

FOR USE IN THE OFFICE . . . AND TO CARRY TO HOSPITAL

PORTABLE BOVIE ON [illegible] CHROME STAND

[illegible]

Built to the same exacting standards as the larger Hospital Bovies, this new Portable Model fills a distinct need for a compact unit that can be readily transported . . . as an inexpensive office unit . . . as a secondary or "standby" unit for hospital service.

Used in the office for desiccation of nevi or blemishes, cervical conization or coagulation, shrinking of inferior turbinates, coagulation of tonsils, aborting boils, coagulating hemorrhoids, taking biopsies, bladder fulguration, coagulating urethral caruncles, incision and sterilization of abscesses, etc.

Used in the Hospital for prostatic resection, electro-hemostasis, cervical conization, hemorrhoide tomies, excision of malignancies, massive coagulation, etc.

EXTREMELY SIMPLE TO OPERATE

You will particularly like the simplicity of the Portable Bovie. To change from cutting to coagulation or vice versa, you merely throw an easily accessible switch -- no connections to be changed, or readjustment of spark gaps -- only a single power control, and all power settings are exact. The terminals are designed so that it is impossible to confuse the connections for the foot switch, supply cable or electrode cords. Identical power output is always delivered at any given setting on the dial. Standardization and duplication of techniques is an established fact!

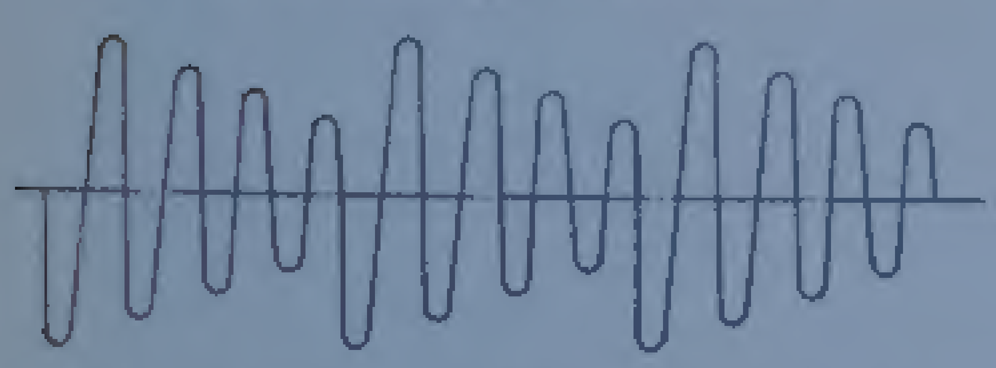
SEND FOR LITERATURE

NO OBLIGATION

All Bovie Units have certain common characteristics.

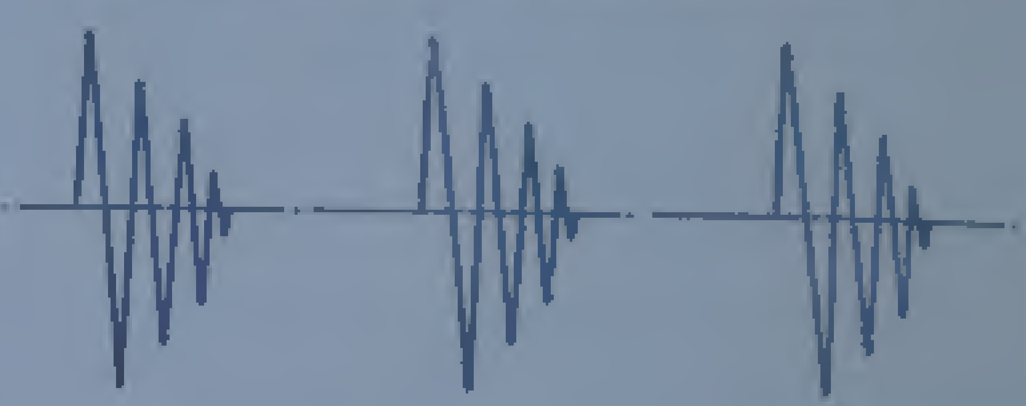
Each model generates two distinct currents.

1-Cutting Current



The slightly damped, ***cutting current*** by volatilization of cells just ahead of the electrode, severs tissue as rapidly as the sharpest scalpel and, while cutting, dehydrates or coagulates a thin layer of cells on the wound edges. This action shrivels and occludes the ends of smaller blood vessels; bleeding and oozing from these sources is inhibited, in some cases actual *"bloodless cutting"* being possible. This marked reduction in hemorrhage is the primary reason for the use of electro-cutting and represents its principal advantage over orthodox methods.

2-Coagulation Current



The higher voltage, highly damped ***coagulation current*** (quite different from the cutting current) has no cutting qualities, but has the proper voltage and wave form for desiccation or dehydration of tissue cells and is used for control of bleeding in prostatic resection, for electro-hemostasis by the *clamp and coagulation* method, for destruction of large or small masses of tissue by desiccation or coagulation, and other applications.

All have proper current characteristics and more than enough power for any electro-surgical work, including Prostatic Resection.

All incorporate certain patented basic principles which result in unfailingly satisfactory operation under the most difficult conditions.

All are thoroughly time-tried, proven machines, with records of thousands of successful operations at the hands of hundreds of different surgeons.

That Bovie Units have been chosen by thousands of leading Neuro, Thoracic, Urologic and General surgeons -- that they have been selected by hundreds of leading institutions throughout the world -- more than justifies the statement that THE STANDARD ELECTRO - SURGICAL EQUIPMENT IS A BOVIE UNIT.

CAUTION

L-F Hovis Electrosurgical Units are sold only for use by qualified physicians and surgeons. The observance of safe and established medical practices is essential to their proper use, otherwise there are possibilities of injury to patients or operators.

PREVENTION OF HIGH FREQUENCY SKIN BURNS

Burns are possible either from the indifferent electrode (if improperly prepared and applied) or from the active electrode if it is carelessly handled or laid on the patient when not in use.

Edges of the indifferent plate should be turned back on themselves and applied away from the patient's skin. The plate should be rolled flat each time before using (wrinkles, irregularities or sharp points will cause concentration of current and probable burns). To insure good contact, the plate and patient's skin should have a generous application of heavy soap lather or K-Y Jelly and, under no circumstances, should the plate be applied over hair or hard scar tissues. Hair and scar tissue are non-conducting and may cause concentration of current at other points under the electrode.

When not in use, the chuck handle and active electrode should be placed on the sterilizable instrument rack attached to the machine because, if laid on top of patient, a burn may result if footswitch is depressed.

PREVENTION OF BURNS RESULTING FROM ACCIDENTAL IGNITION OF INFLAMMABLE FLUIDS

When an inflammable fluid (such as alcohol) is used to cleanse the field preparatory to surgery, it is well to remember that there is possibility of igniting any residual liquid by a spark from the electrode. When inflammable fluids or solvents are used, allow sufficient time for complete evaporation and be sure that dressings, coverings, clothing, etc., surrounding the field are not saturated with the liquid.

PREVENTION OF EXPLOSION FROM IGNITION OF INFLAMMABLE INHALANT ANAESTHETICS

The use of an electrosurgical machine imposes some limitations on the type of anaesthetics which can be safely used. Choice of anaesthesia should be made with full consideration of the danger of using electrical sparks in the presence of explosive gasses.

Some gasses, such as ethylene, cyclopropane and vinyl ether, are so explosive in small concentrations that they should never be used with electro-surgery. Ether, while dangerous in the absence of proper precautions, can be used with reasonable safety by the "closed method" if the patient's head and the anaesthetist are separated from the operating field by moist drapes, if the operating room is continuously ventilated, and care is taken to prevent spillage and to immediately remove empty ether cans.

It should be recognized, of course, that all commonly used inhalant anaesthetics are inflammable and especially so when used with oxygen. Therefore, caution is advised even when such "comparatively safe" gasses as nitrous oxide and chloroform are used.

No inhalant of even the slightest degree of inflammability should be used when there is any communication between the operating field and the respiratory passages.

With present day techniques for administering spinal, intra-muscular, oral and rectal anaesthetics, together with the safer gasses, the surgeon has a wide choice from which to select an appropriate anaesthesia for any electrosurgical procedure.

REPRINTS & TECHNICAL DATA

DESCRIBING USES OF THE

Bovie

ELECTRO-SURGICAL UNIT

THE LIEBEL-FLARSHEIM CO.

303 WEST THIRD STREET CINCINNATI, O.